Ollscoil na hÉireann, Corcaigh

National University of Ireland, Cork

University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

Sustainably reconciling offshore renewable energy developments with Natura 2000 sites: An adaptive management framework

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for a degree of

Doctor of Philosophy

University College Cork

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May 2019

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DECLARATION

I, Célia Le Lièvre, hereby certify that the submitted thesis is my own work. It was completed while registered as a candidate for the degree of Doctor of Philosophy in law at University College Cork. I certify that the present thesis has not been submitted for another degree, either at University College Cork or elsewhere in another Institution.

ACKNOWLEDGEMENTS

The accomplishment of this doctoral thesis would not have been possible without the support and supervision of Prof. Owen McIntyre, Dr. Anne-Marie O'Hagan from University College Cork. They have continuously provided me with invaluable guidance and generous help in the writing of my drafts. I would also like to thank my partner and best friend, Michael O'Connor, who never ceased to encourage me throughout this challenging academic journey.

ABBREVIATIONS

AA	Appropriate Assessment
ABC	Acceptable Biological Change
AAM	Active Acoustic Monitoring
AG	Advocate General
AM	Adaptive Management
AMP	Adaptive Management Plan
CIA	Cumulative Impact Assessment
CFI	Court of First Instance
CJEU	Court of Justice of the European Union
CMAMP	Collision Monitoring and Adaptive Management Plan
DP	Decommissioning Programme
DRIP	Data Rich Information Poor
EAP	Environmental Action Plan
EC	European Commission
EIA	Environmental Impact Assessment
EIP	Environmental Integration Principle
EMEC	European Marine Energy Centre
EMF	Electromagnetic Fields
EMP	Environmental Management Plan
ESA	Endangered Species Act
EU	European Union
FORCE	Fundy Ocean Research Centre for Energy
GW	Gigawatt

HBD	Habitats Directive
HMP	Habitats Management Plan
IEA-OES	International Energy Agency Ocean Energy System
IUCN	International Union for Conservation of Nature
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change
MW	Megawatt
MSP	Marine Spatial Planning
N2000	Natura 2000
NEPA	National Environmental Protection Act
NI	Northern Ireland
NOAA	National Oceanographic and Atmospheric Administration
PCOD	Population Consequences of Disturbance
O.J.	Official Journal of the European Union
ORE	Offshore Renewable Energy
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
OWF	Offshore Wind Farms
PAM	Passive Acoustic Monitoring
PBR	Potential Biological Removal
REN	Renewable Energy (Directive)
SAC	Special Area of Conservation
SCAN	Scientific Committee on Animal Nutrition
SHMP	Species and Habitats Management Plan
SNH	Scottish National Heritage
SPA	Special Protection Area

SDG	Sustainable Development Goals
TEU	Treaty on the European Union
TFEU	Treaty on the Functioning of the European Union
UNFCCC	United Nations Framework Convention on Climate Change
UNTS	United Nations Treaty Series
WOZEP	Offshore Wind Ecological Programme

LIST OF PUBLICATIONS

Le Lièvre C, 'Sustainably reconciling offshore renewable energy with Natura 2000 sites: an interim adaptive management framework' (2019) 129 Energy Policy, 491

Le Lièvre C, 'The judicial interpretation of the Habitats Directive by the CJEU: a high water mark for offshore renewable energy developers' (2018) Journal of Energy and Natural Resource law. DOI: 10.1080/02646811.2018.1491194

Le Lièvre C, 'Towards a better management framework reconciling full-scale marine energy deployments with Natura 2000 sites' conservation objectives' (International Conference on Ocean Energy, 12-14th June 2018, Cherbourg)

Le Lièvre C, O'Hagan A.M, 'Legal feasibility for Maritime Spatial Planning' in Karydis M, Kitsiou D, (eds.) *Marine Spatial Planning: Methodologies, Environmental Issues and Current Trends* (Marine Science and Technologies, Nova, 2017)

ABSTRACT

This thesis investigates how the ecosystem-based principles of resilience and adaptive management can be best implemented under the appropriate assessment of the Habitats Directive to reconcile the increasing demand for offshore renewable energy (ORE) and biodiversity conservation. Particular heed is given to the question of how the implementation of the Habitats Directive can be coupled with the development of nascent ORE technologies and the potential impacts these innovations may have on marine Natura 2000 species and their habitats. More specifically, the research challenges the strict interpretation of the precautionary principle which has been crystallised by the EU judiciary under the regime of Article 6(3) of the Habitats Directive. The jurisprudential interpretation of the Habitats Directive needs to evolve in order to better reflect the ecological and infrastructural challenges associated with deploying innovative renewable energy technologies in dynamic and complex offshore environments. In this vein, the thesis suggests a novel approach to interpretation of the Habitats Directive to help accommodate these legal challenges. In so doing, it reinforces the interface between law and ecological science and considers the utility of embracing the principles of adaptive management as a better methodology to enhance the outcomes of the appropriate assessment and reconcile the interests for offshore renewables and protection of Natura 2000 sites. The aim of this research is solution-based: it seeks to improve the implementation of the assessment requirements of the Habitats Directive before they truly become an 'obstacle course' for offshore renewable energy developers.

CHAPTER I

INTRODUCTION

'In developing climate change law, we must not forget the need to protect and enhance biodiversity. [....] we should discourage carbon sequestration projects that reduce biodiversity and social well-being. Instead, we should seek win-win sustainable development solutions that reduce [greenhouse gas emissions] while protecting and enhancing biodiversity'. [1]

(Hodas, 2008)

This statement embraces the core theme of this thesis. The noteworthy statement made by Andrew Jackson whereby 'the strictness of the EU's biodiversity protection could necessitate the rejection of many renewable energy projects'[2] still holds true today. As far back as 2011, the same author raised a number of critical interrogations, in particular that of whether 'provisions aimed at biodiversity protection are sacrosanct even if their application impedes policies aimed directly at addressing climate change?' Needless to say, this remains an everyday challenge for legal practitioners and regulatory decision-makers in charge of administering and granting development consents to developers of

[1] This statement was first enunciated by Hodas and subsequently reiterated by Jackson in his seminal paper addressing policy conflicts between renewable energy and biodiversity conservation (see quotation below). David R. Hodas, 'Biodiversity and Climate Change Law' in Jeffrey M.I., Firestone J., Bubna-Litic K., *Biodiversity, conservation, law + livelihoods: Bridging the North-South Divide* (Cambridge University Press, 2008), 399

[2] Andrew Jackson., 'Renewable energy vs. Biodiversity: Policy conflict and the future of nature conservation' (2011) 21 Global Environmental Change, 1195

offshore renewable energy technologies.[3] Surprisingly, the topic has received scant attention from legal scholars.

1 - Context

Energy law and policy have significantly evolved since the adoption of the European Coal and Steel Community Treaty[4] and the Euratom Treaty[5] in the aftermath of Second World War. 'Energy law' is best defined in the literature as 'the regulation of energy related rights and duties of various stakeholders over energy resources over the energy life-cycle'.[6] In the most recent scholarship, the terms 'modern energy law' has also emerged to reflect the evolution of the drivers behind the development of energy law and policy.[7] While EU energy law and policy have traditionally been driven by energy security and economic motivations,[8] it is now experiencing a paradigm shift towards achieving societal goals, which among other things demand the transition to equitable and affordable low-carbon economies.[9] The 'Clean Energy for all Europeans' legislative package seems to confirm this point and tells us the direction that the EU is willing to take beyond 2020: 'putting energy efficiency first', achieving 'global leadership in renewable energy' while 'ensuring that the transition to a clean energy system benefits all Europeans' including the most 'vulnerable and energy poor consumers'.[10] Not by chance, combating climate change has played a pivotal role in initiating the 'greening'

[3] Glen Wright, Anne-Marie O'Hagan, 'Ocean energy projects: issues, challenges and opportunities' in Wright G., Kerr S., Johnson K., (eds.) Ocean Energy: Governance Challenges for Wave and Tidal Stream Technologies (Routledge, 2018), 101
[4] Treaty establishing the European Coal and Steel Community (adopted 18 April 1951, in force 23 July 1952) (no longer in force)
[5] Treaty Establishing the European Atomic Energy Community [1997] OJ L 327/1
[6] Raphael J. Heffron and Kim Talus, 'The Evolution of Energy Law and Energy Jurisprudence: Insight for Energy Analyst and Researchers' (2016) 19 Energy Research and Social Science, 1, 4
[7] Raphael J. Heffron, 'The global Future of Energy Law' (2016) 7 International Energy Law Review, 290
[8] Ibid.
[9] Darren McCauley and others, 'Energy justice in the transition to low carbon energy systems: exploring key themes in interdisciplinary research' (2019) (233-234) Applied Energy, 916
[10] European Commission, 'Clean Energy for All Europeans' (Communication) COM (2016) 860 final, p.3

process of the EU energy law under the auspice of sustainable development.[11] To comply with its obligations under of the UNFCC[12] and its Kyoto Protocol,[13] the EU has committed to reducing greenhouse gas emissions to 80-95% below 1990 levels by 2050.[14] The Kyoto Protocol and the more recent Paris Agreement[15] have had a significant role in spurring the adoption of legally binding targets for renewable energy under the Renewable Energy Directive (REN Directive).[16] The current 2020 climate and energy framework sets an EU target to achieve 20% of renewable energy consumption which relies on legally binding national targets until 2020.[17] The revised REN Directive establishes a new governance framework setting out an initial renewable energy target of 27% by 2030.[18] This target has been elevated to achieve at least 32% of renewable energy consumption by 2030.[19] The new framework is only legally-binding at the EU level and will be fulfilled through individual Member States' contributions.[20]

Achieving these climate-energy targets demands a radical transformation of our energy systems. In many jurisdictions, offshore renewable energy will soon become an

[11] Israel Solorio and others, 'The European Energy Policy and its "Green dimension": Discursive Hegemony and Policy Variations in the Greening of Energy Policy' in Barnes P., Hoerber T., (eds*)* *Sustainable development and Governance in Europe* (1st edn, Routledge, 2013), 91

[12] United Nations Framework Convention on Climate Change (adopted 9 May 1992, entered into force 21 March 1994) 1771 UNTS 107 (UNFCC)

[13] Kyoto Protocol to the United Nations Framework Convention on Climate Change (adopted 11 December 1997, entered into force 16 February 2005) UN Doc FCCC/CP/1997/7/Add.1, Dec. 10, 1997; 37 ILM 22 (1998)

[14] European Commission, 'Energy Roadmap 2050' (Communication) COM (2011) 885 final. This target includes milestones to achieve 40% emission cuts by 2030 and 60% by 2040: European Commission, 'A Roadmap for moving to a competitive low carbon economy by 2050' (Communication) COM (2011) 112 final.

[15] Paris Agreement (adopted 12 December 2015, entered into force 4 November 2016) UNTS 54113

[16] Directive 2009/28/EC of 23 April 2009 on the provision of the use of energy from renewable energy sources (REN Directive) [2009] O.J. L. 140/16

[17] European Commission, '20 20 by 2020 Europe's climate change opportunity' (Communication) COM (2008) 30 final.

[18] European Commission, 'Proposal for a Directive on the promotion of the use of energy from renewable sources (recast)' (Communication) COM (2016) 767 final.

[19] European Commission, 'European leads the global clean energy transition: European Commission welcomes ambitious agreement on further renewable energy development in the EU' (Press Release, 14 June 2018). Available at <http://europa.eu/rapid/press-release_STATEMENT-18-4155_en.htm> (22 November 2018); European Council, 'Renewable Energy: Council confirms deal reached with the European Parliament' (Press release, 27 June 2018). <https://www.consilium.europa.eu/en/press/press-releases/2018/06/27/renewable-energy-council-confirms-deal-reached-with-the-european-parliament/> (accessed 28 October 2018)

[20] European Commission, (n18), at 2

imperative element of national energy policies to address growing opposition to onshore wind farms.[21] Examples of public opposition abound across the European Union,[22] suggesting a general preference for offshore developments.[23] In Ireland, local opposition has reached such a degree that two-thirds of terrestrial wind farm developments are subject to legal challenges.[24] Similar to Ireland, public opposition to onshore wind farms is also evident in France, albeit in different ways. French opposition has sometimes led to the total destruction of wind turbines by fire.[25] More than 58% of permit applications in France are subject to legal proceedings because of their perceived detrimental impact upon the landscape.[26] As these statistics suggest, up-scaling wind energy developments on already 'crowded' lands is not straightforward. New forms of renewable energy must therefore be imperatively deployed offshore.

For the sake of clarity, 'offshore renewable energy' should be understood as any type of renewable energy technology deployed in the marine environment. Offshore wind technologies, either fixed or floating offshore wind farms, as well as wave and tidal energy developments will be the focus of this investigation. These technologies are the most technologically advanced forms of renewable energy technologies deployed in

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[21] Edward A. Willsteed and others, 'Obligations and aspirations: A critical evaluation of offshore wind farm cumulative impact assessment' (2018) 82 Renewable and Sustainable Energy Reviews, 2332

[22] John K. Kaldellis and others, 'Environmental and social footprints of offshore wind energy. Comparison with onshore counterparts' (2016) 92 Renewable Energy, 543; Kaldellis and others, 'Comparing recent views of public attitude on wind energy, photovoltaic and small hydro applications' (2013)52 Renewable Energy, 197; Jacob Ladenburg, 'Attitudes towards on-land and offshore wind power development in Denmark; choice of development strategy' (2008) 33(1) Renewable Energy, 111

[23] Kristina Ek and Lars Persson, 'Wind farms – where and how to place them? A choice experiment approach to measure consumer preferences for characteristics of wind farm establishments in Sweden' (2014) 105 Ecological Economics, 193

[24] Michael M. O'Connor, 'Gone with the Wind: The Uncertain Pursuit of Ireland's 2020 RES-E Target – An Overview' (2017) 24(4) Irish Planning and Environmental Law Journal, 148

[25] Ouest France, 'Drome. L'incendie de deux éoliennes revendiqué sur un site libertaire' (20 June 2018) https://www.ouest-france.fr/auvergne-rhone-alpes/drome-l-incendie-de-deux-eoliennes-revendique-sur-un-site-libertaire-5835830 (20 October 2018); The Local, 'Why do so many people in France hate wind farms?' (7 August 2018) < https://www.thelocal.fr/20180807/why-do-some-people-in-france-hate-wind-farms-so-much> (accessed 17 October 2018) <https://www.thelocal.fr/20180807/why-do-some-people-in-france-hate-wind-farms-so-much> (15 September 2018)

[26] ADEME, (2017), Etude de la filière éolienne, bilan, prospective et stratégies (Part 2A). Available at < https://www.ademe.fr/sites/default/files/assets/documents/filiere_eolienne_francaise_partie2a_perspectives.pdf> (accessed 13 March 2018), at 37

Europe.[27] 'Ocean energy' is also generally defined by the International Energy Agency Ocean Energy Systems (IEA-OES) as energy harnessed from ocean waves, tidal ranges (rise and fall), tidal currents, ocean currents as well as ocean thermal energy and salinity gradients in seawaters.[28] In this thesis, the term 'ocean renewable energy' will exclusively refer to wave and tidal energy devices approaching commercialisation.

To date, licensing processes represent a significant regulatory obstacle to many developers of ORE technologies due to current uncertainties regarding the impacts of these nascent technologies on marine ecosystems.[29] While the ORE sector provides an innovative source of low-carbon energy, developers still face significant regulatory challenges to meet licensing requirements relating to environmental assessment processes.[30] The Renewable Energy Directive requires that Member States ensure that permitting procedures for renewable energy projects are proportionate and necessary.[31] In a similar vein, the amended Environmental Impact Assessment (EIA) Directive[32] also mandates for proportionate monitoring requirements.[33] Interestingly, compliance with these requirements is not only hampered by the administrative complexity of licensing procedures in national jurisdictions,[34] but also by the legal requirements deriving from

[27] International Energy Agency, (2018), 'Offshore Energy Outlook' <https://www.iea.org/weo/offshore/> (accessed 12 February 2017); Andreas Uihlein and Davide Magagna, 'Wave and tidal current energy – A review of the current state of research beyond technology' (2016) 58 Renewable and Sustainable Energy Review, 1070, 1071

[28] Ocean Energy Systems, 'What is ocean energy' < https://www.ocean-energy-systems.org/about-oes/what-is-ocean-energy/> (accessed 15 March 2017)

[29] Le Lièvre C., O'Hagan A.M, Culloch R. Bennet F., (2016). 'Legal Feasibility of implementing a risk-based approach and compatibility with Natura 2000 network'. Deliverables 2.3 & 2.4 RiCORE project. 53pp. <http://ricore-project.eu/wp-content/uploads/2016/07/RICORE-D2-3D2-4-Legal-feasibility-Final-1.pdf> (accessed 10 January, 2017), at 4

[30] European Commission, 'Study on Lessons for Ocean Energy Development' (final report, April 2017). <https://publications.europa.eu/en/publication-detail/-/publication/03c9b48d-66af-11e7-b2f2-01aa75ed71a1/language-en>, (15 April 2018), at 24-25

[31] Renewable Energy Directive, Article 13(1)

[32] Directive 2014/52/EU of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment [2014] O.J. L. 124/1 (EIA Directive)

[33] EIA Directive, Article 13(1)

[34] Le Lièvre C., O'Hagan A.M., (2015). Legal and Institutional Review of National Consenting Processes, Deliverable 2.2, RiCORE project, 53pp. <http://ricore-project.eu/wp-content/uploads/2016/02/RiCORE-D2.2-Legal-Institutional-Review-Final-1.pdf> (accessed 15 November 2016)

EU environmental directives. Paradoxically, the transition process to renewable energy may be slowed down precisely because of one of the 'cornerstone'[35] of the EU biodiversity policy: the Habitats Directive.[36]

The Habitats and Birds Directives,[37] also referred to as 'Nature Directives',[38] aim to maintain and restore the conservation status of vulnerable species of plants and animals including wild birds and their habitats across their natural range within the EU. The foundation stone of their protection scheme relies on the creation of the network of Natura 2000 sites (hereafter: N2000), an ecologically coherent network of protected areas spanning the territory of the EU.[39] In essence, the Habitats and Birds Directive establish substantive obligations on Member States to designate Special Areas of Conservation (SACs)[40] and Special Protection Areas (SPAs)[41] and to adopt within these sites, special conservation measures for a number of plant and animal species including wild birds and natural habitats naturally occurring within the EU territory. Along with SPAs designated for bird species listed under Annex I of the Birds Directive and naturally occurring migratory birds, SACs form the N2000 network.[42] Any new development located within or in the immediate vicinity of these designated sites must be subject to an assessment, also known as 'appropriate assessment' (hereafter: AA process), of its implications for the site concerned.[43]

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[35] European Commission, 'Guidance document Wind Energy Development and Natura 2000' (2011) <http://ec.europa.eu/environment/nature/natura2000/management/guidance_en.htm> (accessed 20 March 2017), at 17

[36] Directive 92/43/ECC of the Council of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (Habitats Directive) [1992] OJ L 206/7

[37] Directive 2009/147/EC of 30 November 2009 on the conservation of wild birds (Birds Directive) [2009] OJ L20/7

[38] European Commission, 'Fitness Check of the EU Nature Legislation (Birds and Habitats Directives)' (Commission Staff Working Document) SWD (2016) 472 final, at 6

[39] Habitats Directive, Article 3(1)

[40] Habitats Directive, Article 3(2), Article 4(1)

[41] Birds Directive, Article 4(1) (2)

[42] Habitats Directive, Article 3(1)

[43] Habitats Directive, Article 6(3)

N2000 sites have been found to be important pillars of biodiversity conservation, providing a so-called ‘umbrella benefit’ for a wide range of listed and non-listed animal species.[44] As for the effects on marine wildlife, recent research has begun to reveal some positive effects on seabirds.[45] To date, the network of N2000 sites in Europe’s seas is however largely incomplete[46] and covers only 7% of the total EU marine territory.[47] The relatively low coverage of marine N2000 sites, compared to their terrestrial counterparts, suggests that significant knowledge gaps about species and habitats in offshore areas have not been addressed yet.[48] Notwithstanding difficulties in designating marine N2000 sites, the potential for conflicts and spatial overlap with offshore renewable energy should not be minimised. The expansion of the marine network has more than doubled in the last six years.[49] Likewise, an important proportion of offshore wind energy projects in the Irish Sea, North Sea and Baltic Sea are located within or nearby N2000 sites. This is clearly noticeable when visualising and combining the Natura 2000 network viewer (http://natura2000.eea.europa.eu/#) with global offshore wind farms database (https://www.4coffshore.com/offshorewind/).

Furthermore, the EU Biodiversity Strategy to 2020 sets a headline target ‘to halt the loss of biodiversity and the degradation of ecosystem services in the EU by 2020’.[50] To

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[44] European Commission, ‘Fitness Check’ (2016), (n38), at 42
[45] Fjona Sanderson and others, ‘Assessing the Performance of EU Nature Legislation in Protecting Target Bird Species in an Era of Climate Change’ (2016) 9 Conservation Letters, 172; Clara Péron and others, ‘Importance of coastal marine protected areas for the conservation of pelagic seabirds: the case of Vulnerable velkouan shearwaters in the Mediterranean Sea (2013) 168 Biology Conservation, 210
[46] European Commission, ‘Fitness Check’, (n38), p.33
[47] European Commission, ‘Natura 2000 in the marine environment’ <http://ec.europa.eu/environment/nature/natura2000/marine/index_en.htm> (accessed 20 March 2018)
[48] European Environment Agency, ‘Marine Protected Areas in Europe’s seas’ (EEA Report, 2015) <https://www.eea.europa.eu/publications/marine-protected-areas-in-europes> (16 September 2018), p.15
[49]European Environment Agency, ‘Natura 2000 Barometer’ <https://www.eea.europa.eu/data-and-maps/dashboards/natura-2000-barometer> (accessed 11 November 2018)
[50] European Commission, ‘Our life insurance, our natural capital: an EU biodiversity strategy to 2020’ (Communication) COM (2011) 244 final, at 2

achieve this headline objective, the Strategy has adopted measurable targets[51] and demands the full completion of the N2000 network in the marine environment.[52] In this vein, the Fitness Check of the Birds and Habitats Directives[53] indicates that a substantial number of additional marine sites will have to be designated by Member States to complete the N2000 network.[54] The expansion of the marine N2000 network is obviously of paramount importance to stave off the loss of marine biodiversity. Yet, biodiversity objectives should not mean dismissal of the achievement of climate-energy objectives adopted under the EU Climate and Energy Package and the more recent 2030 Climate and Energy Framework. In other locations of the world, coastal nations have also committed to protect 10% of their coastal and marine waters with marine protected areas by 2020 under Sustainable Development Goal 14.[55] Progress towards this goal will also be evaluated according to the number of protected areas in relation to marine areas.

The 'greening' process of energy law should impact more significantly upon the judiciary, and more particularly, upon how European Courts deal with ORE technologies in their adjudications. Accommodating innovative ORE technologies and their potential impacts on dynamic and poorly understood marine ecosystems is necessarily a source of 'legal disruption'[56] which needs to be addressed by the judiciary when providing authoritative interpretations of the legal framework.[57] Leading commentators argue that 'central to addressing the problem of climate change is [the

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[51] Ibid, at .5, 11. Target 1 of the Strategy aims to 'halt the deterioration in the status of all species and habitats covered by EU nature legislation and achieve a significant and measurable improvement in their status so that by 2020': (i) 100% more habitat assessments and 50% more species assessments under the Habitats Directive show an improved conservation status; and (ii) 50% more species assessments under the Birds Directive show a secure or improved status.
[52] Ibid, 11
[53] European Commission, (n38)
[54] Ibid, p.33: The Fitness Check indicates that around 55% additional sites must be proposed by Ireland to complete the N2000 network, against 75% in Belgium, 82% in Spain, 75% in Finland and 72% in Portugal.
[55] UNGA Res. A/RES/70/1 (2015) GAOR 70th Session Supp16, 23
[56] Elizabeth Fisher, 'Law and Energy Transitions: Wind Turbines and Planning Law in the UK' (2018) 38 (3) Oxford Journal of Legal Studies, 528, 531
[57] Ibid, 553

need] to recognize the interrelationships between energy and the environment and the detrimental human consequences that follow from ignoring that linkage'.[58] Notwithstanding this, we are now in a paradoxical situation where the interpretation of the Habitats Directive may become not an environmental benefit, but an obstacle standing in the way of innovative low-carbon energy technologies. Applying the precautionary principle, the European Court of Justice (CJEU) has consistently held that national licensing authorities may authorise new developments only 'if no reasonable scientific doubt' remains as to the absence of threats to the integrity of nearby N2000 sites.[59] In order to comply with the principles elaborated by the CJEU, licensing authorities are therefore inevitably inclined to adopt an overly risk-averse approach to decision-making imposing very extensive monitoring requirements on developers to support the conclusions of an AA process. To date, the approach has been to request large amounts of environmental data and information: an expensive and time-consuming approach for developers of ORE technologies.[60] The judicial interpretation of the Habitats Directive does not sit easily with the emerging challenges associated with deploying new ORE technologies in offshore environments. Even so, the position of the EU judiciary seems to exacerbate a long-standing 'disconnection' between environmental law and science.[61] The interpretation of the Habitats Directive appears particularly impractical given the high degree of uncertainty surrounding complex marine ecosystems. There are indeed, major gaps in our understanding of how complex and dynamic marine ecosystems interact with ORE technologies. Uncertainty and lack of knowledge is not limited to interactions of devices with the receiving environment

[58] Raphael J. Heffron and others, 'A treatise for energy law' (2018) 11 Journal of World Energy Law and Business, 34, 45
[59] Case C-127/02 *Landelijke Vereniging tot Behoud van de Waddenzee and Nederlandse Vereniging tot Bescherming van Vogels v Staatssecretaris van Landbouw, Natuurbeheer en Visserij (Waddenzee)* [2004] ECR I-07405, para.59
[60] Craig Whelton, Lynsey Reid, 'Providing information to enable the decision-taker to make an appropriate assessment' (2018) 186 Scottish Planning and Environmental Law, 45
[61] Jonathan W. Moore and others, 'Towards linking environmental law and science' (2018) FACETS, 374

but also pertain to the fundamental biology of marine habitats and species. Addressing scientific gaps cannot be a developer's responsibility; it demands a societal response from governments, academia and industry all collaborating together. In the absence of strategic mapping and planning systems afforded by governmental authorities, existing data gaps are however only addressed by developers in the framework of licensing processes.[62]

The EU hosts 84% of total worldwide offshore wind installed capacity equating 16 MW.[63] The offshore wind energy sector is projected to grow exponentially to a total capacity of 25 MW by 2020.[64] In light of these figures, it is difficult to believe that the implementation of the assessment requirements of the Habitats Directive threatens this thriving industry. Other sectors such as wave and tidal energy are however edging towards commercialisation. In the absence of grid storage systems capable of storing large amounts of energy generated by offshore wind farms, these innovations offer a predictable source of energy which is indispensable alongside land-based and offshore wind energy developments. In June 2018, low wind conditions resulted in the United Kingdom experiencing a significant decline in its wind energy generation (from 6000MW to 500MW). The country spent more than nine days without any power from wind energy.[65]

Efforts to reduce uncertainty have, however, resulted in ocean energy companies facing disproportionate monitoring costs to meet the evidentiary thresholds of the Habitats

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[62] Julia Köller, Johann Köppel, Peters Wolfgang, (eds.). *Offshore Wind Energy. Research on Environmental Impacts* (Springer, 2006), 346

[63] Global Wind Energy Council (2018), Annual Market Update 2017 Global Wind Report. <http://gwec.net/policy-research/reports/> (accessed 15 March 2018), at 54

[64] Wind Europe, 'Offshore wind in Europe: Key Trends and Statistics 2017' (February 2018). Available at <https://windeurope.org/about-wind/statistics/offshore/european-offshore-wind-industry-key-trends-statistics-2017/> (accessed 15 March 2018), at 7

[65] Rachel Morison, 'Britain has gone nine days without wind Power' Bloomberg (7 June 2008). <https://www.bloomberg.com/news/articles/2018-06-07/u-k-wind-drought-heads-into-9th-day-with-no-relief-for-weeks> (accessed 15 November 2018)

Directive.[66] An Irish development company was even forced to cancel its foreshore licence application for its single tidal energy device located adjacent to a SPA due to additional requirements for bird surveys in the Shannon estuary.[67] Applying the precautionary principle to ORE permitting is of course necessary. However, an overreliance on the precautionary principle will certainly fail to achieve satisfactory trade-offs between the demand for biodiversity conservation and the increasing need to diversify our renewable energy portfolio.

[66] For example, Marine Current Turbines (MCT) has spent £3 million on monitoring works to obtain consent for their single tidal energy turbine (SeaGen) installed in Strangford Lough. See further: Riddoch L., (2009) 'Seal of Approval' *The Nature of Scotland*, (Winter Issue), at 22-23

[67] Lorna Siggins, 'Planning hitch forces renewables firm to pull Shannon project' *The Irish Time* (Dublin, 13 August, 2018)

2 - Research questions and objectives

While the ORE sector offers promising benefits for 'Blue Growth'[68] opportunities and access to modern energy services,[69] ORE also represents an additional source of pressure and physical disturbance to marine ecosystems. The purpose of this thesis is not therefore to subvert the precautionary principle but to promote better coherence between EU goals for renewable energy and biodiversity conservation. However, the thesis advances the premise that the relatively nascent nature of ORE technologies coupled with the existence of considerable data gaps and uncertainty on the receiving environment demand a paradigm shift[70] in our approach to assessing and managing the impacts of the ORE sector on marine N2000 sites. Scientific uncertainty is so pervasive in the marine environment that decision-makers and, ultimately the courts that flesh out the precautionary principle, will need to develop a nuanced approach to the application of the principle to put the 'inevitable fact of scientific uncertainty'[71] at the core of decision-making.

The Fitness Check found that the Birds and Habitats Directives are generally fit for purpose but the full realisation of their potential and stated objectives is nonetheless

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[68] European Commission, 'Maritime Affairs, 'Blue Growth: Opportunities for marine and maritime sustainable growth' (Communication) COM (2012) 494 final, at 8-9. Offshore wind, wave and tidal energy have been identified as one of the five 'value chains' that 'could deliver sustainable growth and jobs in the blue economy'

[69] 'Energy services' are used to describe the benefits that energy systems provide to people. Energy services include 'lighting, heating for cooking, power for transport, grinding, and numerous other services' that telecommunications, 'fuels, electricity and mechanical power make possible'. Modi V., McDade S., Lallement D., Saghir J., *Energy Services for the Millennium Development Goals* (New York, United Nations Development Programmed, 2005). Available at <http://www.undp.org/content/undp/en/home/librarypage/environment-energy/sustainable_energy/energy_services_forthemillenniumdevelopmentgoals.html> (2nd November 2018)

[70] To get a better understanding of the notion of 'paradigm-shift', read Thomas Kuhn's seminal text on this issue: Thomas Kuhn, *The Structure of Scientific Revolutions* (University of Chicago Press 1962)

[71] Emma Lees, *Interpreting Environmental Offences: The Need for Certainty* (Hart Publishing, 2015), 165

contingent upon substantial improvement of their implementation.[72] In a similar vein, the recent Action Plan for 'nature, people and the economy' outlines that those in charge of implementing the Directives 'are sometimes not sufficiently aware of their requirements or of the flexibility and opportunities they offer; this can lead to tensions between nature protection and economic activities'.[73] At first glance, reconciling the protection of marine biodiversity with the need to account for challenges faced by project developers requires a nuanced approach to the precautionary principle to encourage the establishment of best scientific knowledge under the AA process.

A critical challenge confronting planning and licensing decision-makers is indeed, to make 'good' legal decisions in the face of uncertainty regarding the interactions of ORE devices with complex marine ecosystems and their 'acceptability' in terms of impacts on protected features.[74] Acknowledging the 'inertia and paralysis' of natural resource managers in the face of scientific uncertainty, Holling and others developed new paradigms of environmental assessment and management that incorporate the basic principles of resilience and adaptive management.[75] Many environmentalists are still asserting that the only feasible option to deal with uncertainty in complex natural resource problems is adaptive management.[76] In essence, adaptive management is a structured management process that deals with scientific uncertainty through 'a rigorously planned and controlled trial' based on careful monitoring to provide

[72] European Commission, 'Fitness Check', (n38), at 96
[73] European Commission, 'Action Plan for nature, people and the economy' (Communication) COM (2017) 198 final, at 2
[74] E.J Milner-Gulland, Katriona Shea, 'Embracing uncertainty in applied ecology' (2017) 54 Journal of Applied Ecology, 2063, 2063
[75] Holling C.S, and others, *Adaptive Environmental Assessment and Management* (London, Wiley, 1978)
[76] Jim Berckley and Lance Gunderson, 'Practical Resilience: Building Networks of Adaptive Management' in Allen C.R, Garmestani A.S. eds., *Adaptive Management of Socio-Ecological System* (Dordrecht: Springer 2015), 201; Garmestani A.S., Allen C.R., Rhul J.B., Holling C.S., 'The Integration of social-ecological resilience and law' (2014) Nebraska Cooperative Fish & Wildlife Research Unit – Staff Publication 144, 365

feedbacks and periodic review of decisions in the light of new information'.[77] This approach has already been applied in a range of different environmental management contexts including forestry,[78] fisheries,[79] harvest management,[80] wetlands and coral reefs.[81] Given the high degree of uncertainty surrounding marine ecosystems, the ORE sector also represents an excellent opportunity to pilot the use of adaptive management strategies. Although recent research increasingly advocates the use of adaptive management in permitting processes for renewable energy projects, it mostly focuses on onshore wind developments.[82] There has been little literature specifically focusing on the legal feasibility of implementing the principles adaptive management under the AA process of the Habitats Directive in order to facilitate greater penetration of offshore renewable energy. Drawing on the seminal work of Holling, this thesis will thus explore how the established paradigm of ecosystem sciences can be best implemented under the AA process to improve the management of scientific uncertainty associated with permitting offshore renewables. In so doing, this research addresses one the key research priorities identified by the 'legal research agenda' for ocean energy.[83] Recognising that most of the research to date has failed to adequately tackle the legal

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[77] Rosie Cooney and Barney Dickson, 'Precautionary Principle, Precautionary Practice Lessons and Insights' in Cooney R., Dickson B., (eds.), *Biodiversity ad the Precautionary Principle: Risk, Uncertainty and Practice in Conservation and Sustainable Use* (1st edn, Routledge, 2005), at 304-305; International Union for Conservation, (2007) 'Guidelines for applying the precautionary principle to biodiversity conservation and natural resource management' (67th meeting of the IUCN Council 14-16 May 2007), Guideline 12, at 10

[78] Christopher P.O. Reyer and others, 'Models for adaptive forest management' (2015) 15 (8) Regional Environmental Change, 1483

[79] Carl J. Walters, 'Is Adaptive Management helping to solve fisheries problems? (2007) 36 Ambio, 304

[80] James D. Nichols and others, 'On formally integrating science and policy: walking the walk' (2015) 52 Journal of Applied Ecology, 539

[81] Laurence J. McCook and others, 'Adaptive management of the Great Barrier Reef: a globally significant demonstration of the benefits of networks of marine reserve' (2010) 107(43) PNAS, 18278

[82] Lea Bulling and Johann Köppel, 'Exploring the trade-offs between wind energy and biodiversity conservation'. in Geneletti D., (ed.), *Biodiversity and ecosystem services in impact assessment. Research Handbooks on Impact Assessment* (1st edn, Edward Elgar, 2016), 299; Hanna L., and others, (2016). Results of IEA Wind Adaptive Management White Paper (IEA Wind Task 34 Technical Report, December 2016). 46pp. <https://tethys.pnnl.gov/sites/default/files/publications/WREN-AM-White-Paper-2016.pdf>

[83] Glen Wright and others, 'Establishing a legal research agenda for ocean energy' (2016) 63 Marine Policy, 126

and regulatory issues hampering the ORE sector,[84] the agenda identifies the need to develop risk-based and adaptive management strategies that can better accommodate scientific uncertainty within existing legal frameworks as a priority research area.[85] In this respect, the thesis revolves around the following major research questions:

1) How is scientific uncertainty currently addressed by regulatory decision-makers and the EU judiciary under AA processes conducted for renewable energy developments?
2) How can adaptive management be advanced within the confines of the precautionary principle to enhance the outcomes of the AA process in the face of uncertain ecological impacts on N2000 sites?

The outcomes of this research will result in a more sophisticated approach to environmental decision-making for offshore renewable energy that embeds adaptive management and ecosystem-based management principle in an operational way. These findings will provide ORE developers and regulatory decision-makers with greater legal certainty when consenting and managing ORE developments under conditions of scientific uncertainty as to their potential impacts on N2000 sites and their qualifying features.

Further, the recommendations of this research may be particularly useful in light of the future guidance documents contemplated by the Action Plan for 'nature, people and the economy'.[86] Following on from the Fitness Check of the Habitats and Birds Directives, the Action Plan foresees a number of priority actions to improve practical implementation of the Habitats and Birds Directives, and more specifically, their

[84] Ibid.
[85] Ibid, 129, 132
[86] European Commission, 'Action Plan for Nature, People and the Economy' (Communication) COM (2017) 198 final at 2,5

coherence with socio-economic objectives.[87] Recognising that an inflexible application of species protection rules can lead to an unnecessary burden and delays in permitting processes, the Action Plan envisages updating and improving existing methodological guidance on the site permitting requirements of the Habitats Directive and developing new guidance documents on hydropower and wind energy by 2019.[88] The underlying objective of this EU initiative is to promote sector-specific, smarter and more effective permitting procedures for N2000 sites and species protection rules. This research therefore intervenes at a key period in the life of the Birds and Habitats Directives.

2 - Methodology

As the core topic of this thesis relates to the interpretation of the precautionary principle in the particular context of the AA of the Habitats Directive, the thesis applies a doctrinal approach to legal research and as such, it is predominantly based on a critical examination of environmental legislation and case law.[89] Because the thesis intends to develop a methodological framework to optimise the treatment of scientific uncertainty under the AA, it was necessary to supplement the doctrinal research with empirical evidence gathering in order to test the hypothesis. The nature of the marine environment is such that it was not possible to give due consideration to the ecological impacts of the ORE sector without consulting relevant scientific materials and environmental reports commissioned by industry, synthesising recent findings and monitoring results around a number of selected offshore wind farms, ocean energy devices and ocean test facilities. This research does not however follow an empirical methodology. Indeed, it did not include social research method such as interviews, observations or questionnaires. It

[87] See further: European Commission, ‘Factsheets providing details of actions in the Action Plan for nature, people and the economy’ SWD (2017) 139 final.
[88] Ibid, at 8, 19
[89] Dawn Watkins and Mandy Burton, *Research Methods in Law* (2nd edn, Routledge, 2017)

nonetheless involved engaging with peer-reviewed scientific literature as well as pre- and post-consent monitoring reports at the level of a metadata study. The thesis also encompasses an interdisciplinary approach facilitated by the candidate being located in the Marine and Renewable Energy Ireland Centre (MaREI Centre)[90] where leading-edge contemporary developments in scientific practices for ecological assessments in the marine environment are implemented. The research has been approached from the experience of the author who has been involved with industry partners in the completion of multidisciplinary research projects focused on environmental assessments and risk-based consenting for offshore renewables. Hence, this research was embedded within the sector, thereby allowing the author to attain a thorough understanding of ORE technologies, their ecological footprints and practical challenges faced by the industry in securing necessary development consents.

3 - Structure

Chapter II offers a detailed literature review of selected reports and scientific materials synthesising the 'state of art' of scientific knowledge regarding the ecological impacts associated with offshore wind, wave and tidal energy deployments. Chapter III describes the various sources and typologies of scientific uncertainty pervading environmental impact assessments in the offshore renewable energy sector. The 'raison d'être' of these first two Chapters is to provide the scientific background necessary to understand the limits associated with monitoring marine wildlife and acquiring data and information in offshore environments. This discussion will enable the reader to re-consider the dissonance between existing judicial requirements for certainty under the AA of the Habitats Directive and the state of scientific knowledge and methodologies available to ORE developers to predict and measure the potential impacts of their

[90] The MaREI Centre is a Science Foundation Ireland-funded research centre coordinated by the Environmental Research Institute (ERI), University College Cork. <http://www.marei.ie/>

technologies on marine ecosystems. Understanding and conceptualising the different sources of scientific uncertainty will also be critical to inform the question of how the judiciary should navigate that uncertainty in adjudications involving permissions for offshore renewables. In this respect, Chapter IV will offer a constructive criticism of the current interpretation of the precautionary principle developed by CJEU under the AA of Article 6(3) of the Habitats Directive. Having identified potential obstacles and inconsistencies in the interpretation of the CJEU and domestic courts, Chapter V will discuss the complex interactions between the Union's energy and environmental policy under the legal system of the Lisbon Treaty and challenge the position of the EU judiciary in light of the important proportionality principle and the overarching objective of sustainable development.

Chapter VI will then explore the science of adaptive management. In particular, it will define the notion of ecological resilience and adaptive management and inform the question of how these established paradigms of ecosystem sciences can be best implemented in tandem with the precautionary principle to approve and deploy ORE projects under uncertainty without adversely impacting upon N2000 sites' conservation objectives. In this connection, Chapter VI will propose an 'interim' methodological framework to guide the use of adaptive management strategies in AA processes for ORE deployments. Finally, Chapter VII will conclude with a series of legal recommendations to help structure the implementation of adaptive management in a manner that preserves the need for legal and regulatory certainty in consenting processes and reduces the prospect of increased discretion for competent licensing authorities. In this vein, special attention will be paid to the long-standing experience of adaptive management in the American case law in order to derive substantial legal standards under which adaptive management protocols could be lawfully developed to authorise, deploy and operate ORE devices in compliance with the requirements of the Habitats Directive.

Although the thesis is primarily focused upon ORE technologies, the relevance of this research goes beyond the interest of the ORE sector and many of these recommendations are applicable to other forms of renewable energy technologies.

CHAPTER II

MAPPING THE ECOLOGICAL IMPACTS OF OFFSHORE RENEWABLE ENERGY PROJECTS

A LITERATURE REVIEW

1- Introduction

Chapter II offers a detailed review of the 'state of art' of scientific knowledge regarding the ecological impacts of offshore renewable energy (ORE) deployments. As explained in the Introduction to this thesis, offshore wind, wave and tidal energy developments will be the focus of this investigation.[1] The term 'ocean renewable energy' will also be used in section 4 of this Chapter to denote wave and tidal energy devices. 'Environmental assessment' is used as a generic term to refer to the legally prescribed environmental assessment procedures under the amended EIA Directive,[2] the Strategic Environmental Assessment (SEA) Directive[3] and the Habitats Directive.[4] The term 'ecological impacts' is preferred to 'environmental impacts' insofar as this review only covers potential impacts on marine species and their habitats, the physical environment and associated ecosystem processes (i.e. hydrodynamics and sediment transport). It does not include societal aspects such as human population and human health, material assets, cultural heritage and landscape as referred to under Article 3(1) of the EIA

[1] International Energy Agency, (2018), 'Offshore Energy Outlook'. 80pp. Available at < https://www.iea.org/weo/offshore/> (accessed 12 February 2017); Uihlein A., Magagna D., 'Wave and tidal current energy – A review of the current state of research beyond technology' 2016) 58 Renewable and Sustainable Energy Review, 1070, 1071

[2] Directive 2014/52/EU of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment [2014] OJ L 124/1 (EIA Directive)

[3] Directive 2011/42/EC of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment [2011] OJ L.197/30

[4] Directive 92/43/ECC of the Council of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora [1992] OJ L 206/7

Directive. An important semantic distinction must be made between 'effect' and 'impact'. 'Effect' refers to a causal change caused by a stressor to a receptor. 'Effect' does indicate the magnitude or intensity of change for receptors, whereas 'impact' refers to the resultant negative or positive consequences of an effect on receptors.[5] A potential effect, such as increased stress levels or displacement incurred by birds, fish or marine mammals, must be significant enough in intensity and duration to cause a meaningful impact (e.g. decline in population).[6] 'Receptor' must be understood as any ecosystem attribute that responds to pressures and stressors.[7] In this review, receptors include marine mammals, seabirds, fish and benthic communities, physical environment (sediments, seabed and coastal topography) and hydrodynamics (i.e. wave motion and currents).

The Chapter covers the construction, operation, and decommissioning phases of ORE projects. For each of these stages, it highlights the potential impacts on the main sensitive taxa and receptors. The evidence base comes from peer-reviewed scientific papers, book chapters and environmental monitoring reports commissioned by industry developers. This study also extensively relies on the recent review of post-consent monitoring of offshore wind farms (OWFs) published by the UK's Marine Management Organisation (hereafter: MMO).[8] Important background materials included post-consenting monitoring reports produced by consultants or government agencies in relation to installed OWFs including Alpha Ventus, Nysted, Horns Rev I and Horns Rev

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[5] Boehlert G.W., Gill A.B., (2010) 'Environmental and ecological effects of ocean renewable energy development: a current synthesis' Oceanography, 23, 68

[6] Willsteed E., Gill A.B., Birchenough S., Jude S., (2017) 'Assessing the cumulative effects of marine renewable energy developments: establishing common ground', Science of the Total Environment, 577 (15),19, 23

[7] Boehlert G.W., Gill A.B., (n5), at 69

[8] Marine Management Organisation (MMO), (2014), Review of post-consent offshore wind farm monitoring data associated with licence conditions. A report produced for the Marine Management Organisation, MMO Project No: 1031, 194pp. Available at <https://www.gov.uk/government/publications/review-of-environmental-data-mmo-1031> (accessed 15 August 2017), at 121

II (Denmark), Greater Gabbard, Robin Rigg, London Array, North Hoyle and Kentish Flats (United Kingdom), Bligh Bank and Thorntonbank (Belgium) and Egmond aan Zee (Netherlands). Monitoring studies around these developments have typically used a Before-After-Control-Impact' (BACI) approach to monitoring design, assessing/comparing changes/impacts on valued receptors prior to installation, during the construction and during the operational phase. With regard to wave and tidal energy devices, this study extensively relies upon the findings of the Annex IV State of the Science Report on the Effects of Marine Renewable Energy Development Around the World (hereafter: State of the Science Report).[9] This report is the most consolidated scientific contribution reviewing the state-of-the-art of scientific knowledge of the interactions between marine animals, their natural habitats and ocean energy devices.[10] The study also relies on peer-reviewed scientific papers synthesising findings from monitoring programmes in selected ocean test facilities.

Little research has been directed to evaluating the ecological impacts of decommissioning. The number of OWFs that have been decommissioned to date is low. The first decommissioning of an OWF, Yttre Stengrund,[11] occurred at the beginning of 2016 in Sweden, followed by Vindeby[12] in Denmark. The decommissioning programmes of these early OWFs are not accessible for public consultation. At this stage, the potential impacts associated with decommissioning operations may be derived from scientific knowledge gathered for the oil and gas industry and preliminary decommissioning programmes for existing OWFs.

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[9] Copping A., and others, (2016). Annex IV 2016 State of Science Report: Environmental Effects of Marine Renewable Energy Development Around the World. 224pp. <https://tethys.pnnl.gov/publications/state-of-the-science-2016> (accessed 30, July 2018)

[10] Ibid, 1

[11] MAREX, (2016) 'The First Offshore Wind Farm Decommissioning Complete' *The Maritime Executive* (4 February 2016) <https://www.maritime-executive.com/article/first-offshore-wind-farm-decommissioning-complete> (accessed 18 January 2017)

[12] Dong begins Vindeby decommissioning – Wind Power Offshore. Weston D. 2017. < https://www.windpoweroffshore.com/article/1382887/dong-announces-vindeby-decommissioning>

Unfortunately, a large number of decommissioning programmes (hereafter: DP) are not in the public domain. The OWFs that have been studied for decommissioning are therefore different to those studied for the construction and operational phase. DPs for the Greater Gabbard,[13] Sheringham Shoal,[14] London Array,[15] Glun Feet Sand,[16] Gwynt y Môr,[17] and Thanet OWFs[18] have been accessed to establish an overview of the state of empirical knowledge.

2- Ecological footprints of offshore wind farms: what do we know?

2.1. Marine mammals

As discussed above, EU countries host 84% of total worldwide offshore wind installed capacity.[19] Because most current OWF developments operate in the North Sea, Irish Sea and Baltic Sea,[20] empirical data collected to inform regulatory consenting processes have been primarily gathered for marine mammals regularly occurring in these regions: harbour porpoises (*Phocoena phocoena*), harbour seals (*Phoca vitulina*) and grey seals

[13] Airtricity, (2007). Decommissioning programme – Greater Gabbard Offshore Wind Farm Project (Document 570000/403-MGT100-GGR-107). Available at < http://sse.com/media/92981/GGOWL_DecommissioningProgramme.pdf>

[14] Statoil, (2014). Decommissioning Programme Sheringham Shoal (Document NUMBER: SC-00-NH-F15-00005). Available at <http://sheringhamshoal.co.uk/downloads/Decommissioning%20Programme.pdf> (accessed 3 February 2017)

[15] London Array Ltd, (2011). Decommissioning programme for London Array (Doc No: LAL-CEM-000253), p. 21. Available at <http://www.londonarray.com/decommissioning-programme/

[16] Dong Energy, (2012). Gunfleet Sands Decommissioning Plan (Doc. no. 1185457). Available at < http://assets.dongenergy.com/DONGEnergyDocuments/Gunfs/DecommissioningPlan.pdf> (accessed 12 January 2017)

[17] RWE Npower Renewables Ltd, (2011). Decommissioning Strategy Gwynt y Môr Offshore Wind Farm Ltd (Doc GMOL-GM16-1603-EN-001019119-01). <https://www.innogy.com/web/cms/mediablob/en/3171308/data/3171562/1/rwe-innogy/rwe-innogy-uk/sites/wind-offshore/in-operation/gwynt-y-mr/English.pdf> (accessed 6 January 2017)

[18] Thanet Offshore Ltd, (2008). Thanet Offshore Wind Farm Decommissioning Plan. Available at < https://corporate.vattenfall.co.uk/globalassets/uk/projects/decommissioning-plan-2008.pdf>

[19] Global Wind Energy Council (2018), Annual Market Update 2017 Global Wind Report. <http://gwec.net/publications/global-wind-report-2/> (accessed 15 March 2018)

[20] Wind Europe, (2018), Offshore wind in Europe: Key Trends and Statistics 2017 (February 2018). <https://windeurope.org/about-wind/statistics/offshore/european-offshore-wind-industry-key-trends-statistics-2017/> (accessed 3 May 2018)

(*Halichoenus grypus*). Elsewhere, other marine mammal species that have been identified as sensitive to OWFs include the North Atlantic right whale (*Eubalaena glacialis*), common Minke whales (*Balaenoptera acutorostrata)*, blue whale (*Balaenoptera musculus*), humpback whale (*Megaptera novaeangliae*), and fin whale (*Balaenoptera physalus*).[21]

OWFs may affect marine mammals in a myriad of ways. High pulse sound, generated by pile-driving operations, a technique commonly used to secure monopile foundations on the seabed, is the main source of concern for marine mammals. Marine mammals rely on sound to navigate, communicate and detect their prey. High-level sounds during pile-driving operations may mask communication thereby affecting animals' capacity to communicate, detect their mates and hunt. Pulse sounds from pile-driving operations may induce hearing damage that may result in a permanent threshold shift (PTS) (hearing loss) or temporary threshold shift (TPS) (temporary hearing injury).

A growing body of evidence suggests that pile-driving noise leads to the displacement of marine mammals.[22] Harbour porpoises (*Phocoena phocoena*) have been identified as highly susceptible to noise levels from pile-driving operations.[23] A recent study analysing the effects of eight noise-mitigated and non-noise-mitigated OWFs in the German Bight has shown harbour porpoises declined by 68% within 5 km and 20% within 10-15 km from pile-driving sites.[24] The decline in animal presence was more

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[21] Madsen P.T., Wahlberg M., Tougaard J., Lucke K., Tyack P., (2006) 'Wind turbine underwater noise and marine mammals: implications of current knowledge and data needs', Marine Ecology Progress Series, 309, 279

[22] Bailey H., Brookes K.A., Thompson P.M., (2014) 'Assessing the environmental impacts of offshore wind farms: Lessons learned and recommendation for the future', Aquatic Biosystems, 10(8), 1, 3

[23] Brandt M., and others (2016). Effects of offshore on Harbour Porpoises abundance in the German Bight: Assessment of Noise Effects. Report by BioConsult SH, IBL Umweltplaning GmbH and Institute of Applied Ecology (IfAO). 262pp.; Cartensen J., Henriksen O.D, Teilmann J., (2006) 'Impacts of offshore wind construction on harbour porpoises: acoustic monitoring of echolocation activities using porpoise detectors (T-PODs)', Marine Ecology Progress Series, 321, 295

[24] Brandt and others, (n23), 172

than 50% at the nearest distance of 0-5km from OWFs.[25] Aerial surveys combined with static acoustic monitoring at Alpha Ventus OWF also provide evidence of harbour porpoise displacement over a range of 10-20 km.[26] Displacement during pile-driving were confirmed for the Horns Rev I and II, Nysted and Robin Rigg OWFs.[27] At Horn Rev I and II development sites, noise-induced displacement behaviours were detected up to distances of 17 km (Horn Rev II)[28] and 20 km (Horn Rev I) with a recovery time of up to two days for Horns Rev I[29] and 24 to 72 hours (two-three days at a distance of 2.6 km) for Horns Rev II.[30] At Nysted OWF, acoustic monitoring showed that pile-driving provoked a stronger negative reaction in harbour porpoise as animals were seen to leave the area almost completely and needed longer recovery periods after pile-driving.[31] These effects can be explained by the absence of noise mitigation measures during planning and construction of the first OWFs. The range of effects from pile-driving noise on marine mammals reduced from 17km to 14km when working sound mitigation measures were used in the German Bight.[32] According to Nehls and others, using effective sound mitigation systems during offshore pile-driving such as big bubble curtains may result in a substantial reduction of up to 90% in the harbour porpoise disturbance area.[33]

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[25] Ibid.
[26] Dähne M., and others, (2013) 'Effects of pile-driving on harbour porpoises (Phocoena phocoena) at the first offshore wind farm in Germany' Environmental Research Letters, 8(2), 1, 12
[27] Vallejo G.C., and others, (2017) 'Responses of two marine top predators to an offshore wind farm', Ecology and Evolution, 21(7), 8698
[28] Brandt M.J., and other, (2011) 'Responses of harbour porpoises to pile driving at the Horns Rev II offshore wind farm in the Danish North Sea', Marine Ecology Progress Series, 421, 205
[29] Toogaard J., Carstensen J., Teilmann J., (2009) 'Pile driving zone of responsiveness extends beyond 20 km for harbor porpoises (Phocoena phocoena)' The Journal of the Acoustical Society of America, 126, 11
[30] Brandt and others, (n28), at 205, 211
[31] Teilmann J., Carstensen J., (2012) 'Negative long-term effects on harbour porpoises of a large scale offshore wind farm in the Baltic – evidence of slow recovery', Environmental Research Letters, 7, 8
[32] Ibid, 62, 172
[33] Nehls G., and others, (2016) 'Noise Mitigation During Pile Driving Efficiently Reduces Disturbance of Marine Mammals' in Popper N., Hawkins A., (eds.), *The Effect of Noise on Aquatic Life II* (Advances in Experimental Medicines and Biology, vol. 875), 765

Behavioural responses of harbour seals and grey seals to pile-driving operations appear to be similar to that recorded for harbour porpoises.[34] Changes in behaviour were recorded through telemetry studies, visual observations and remotely controlled camera systems in sanctuary and haul-out sites around the Horns Rev and Nysted OWFs.[35] Monitoring data from Nysted and Horns Rev show that seal species are sensitive to pile-driving operations but there was no evidence of deterrent effects during the overall construction period.[36] Significant short-term effects were observed in the number of seals hauling-out during pile-driving.[37] Similarly, a recent study using telemetry data showed that harbour seals clearly avoided the area up to 20 km from Linc OWF (South East England) during pile-driving.[38] Monitoring results at Linc OWF (United Kingdom) suggest that seals would need shorter recovery period as harbour seals were seen to return to site only two hours after piling.[39]

The evidence base above seems to suggest that acoustic disturbances on marine mammals are limited to pile-driving activities. Long-term monitoring at Horns Rev and Nysted has shown that population of marine mammals returned in OWF areas to a comparable number after construction activity had ceased.[40] Monitoring at Egmond aan Zee OWF in The Netherlands also reported a significant increase in harbour porpoise

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[34] Russell D.J.F and others, (2016) 'Avoidance of wind farms by harbour seals is limited to pile driving activities', Journal of Applied Ecology, 53, 1642

[35] Danish Offshore Wind – Key Environmental Issues (Published by DONG Energy, Vattenfall, The Danish Energy Authority and The Danish Forest and Nature Agency, November 2006), 144pp. Available at <https://tethys.pnnl.gov/publications/danish-offshore-wind-key-environmental-issues> (10 December 2016), at 30

[36] Teilmann J., and others, Summary on seal monitoring 1999-2005 around Nysted and horns rev offshore wind farms. Report by ENERGI E2, National Environmental Research Institute (NERI) and Vattenfall A/S, 2006. 22pp. <https://tethys.pnnl.gov/publications/summary-seal-monitoring-1999-2005-around-nysted-and-horns-rev-offshore-wind-farms> (18 December 2016), at 20

[37] Edren S. and others, (2009) 'The effect of large Danish offshore wind farm on harbour and grey seals haul out behaviour' Marine Mammal Science, 26, 614; Skeate E.R., Perrow M.R., Gilroy J.J., (2012) 'Likely effects of construction of Scroby Sands offshore wind farm on a mixed population of harbour *Phoca vitulina* and grey *Halichoerus grypus* seals' Marine Pollution Bulletin, 64(4), 872

[38] Russell and others, (n34), 1649

[39] Ibid, 1650

[40] Danish Offshore Wind, (n35), 89-91

activities within the wind farm during the operational phase.[41] These initial conclusions need to be considered carefully as post-consent monitoring activities at Nysted OWF suggest slow recovery for harbour porpoises, with no return to baseline conditions after one year of operation.[42] The effects of operational, non-pulsed sounds on marine mammals are still poorly understood. Once they become operational, OWFs would generate low levels of acoustic noise disturbance due to the absence of pile-driving. The impact of noise will however depend on the type of foundation structures (e.g. monopile, jackets or gravity foundation), animals' previous experience of noise exposure, the hearing sensitivity and motivation of marine mammals.[43] The need to forage and haul-out may, for example, outweigh the deterrence effects of noise disturbance.[44] This may explain regular transiting behaviour of foraging harbour seals around the Linc OWF during pile-driving operations.[45] Underwater noise emitted by maintenance vessels during the construction and operational phase may also be detectable by marine mammals.[46] Harbour porpoises have been reported to react to low-frequency noise emissions from boat activities during the operational phase.[47] Brandt *et al*., demonstrated that lower numbers of harbour porpoises were found around all OWFs as a result of boat activities prior to piling-driving operations.[48]

[41] Scheidat M. and others, (2011) 'Harbour porpoises (*Phocoena phocoena*) and wind farms: a case-study in the Dutch North Sea' Environmental Research Letters, 6, 10

[42] Teilmann and Carstensen, (n31), 7-9

[43] Marmo B., and others, (2013). Modelling of Noise Effects of Operational Offshore Wind Turbines including noise transmission through various foundation types. Edinburgh: Scottish Government. 100pp. 10.7489/1521-1. <https://data.marine.gov.scot/dataset/modelling-noise-effects-operational-offshore-wind-turbines-including-noise-transmission> (accessed 20 June 2017), 9-11, 77; Harwood J., King, S.L., (2017), The Sensitivity of UK Marine Mammals Populations to Marine Renewable Energy Developments – Revised Version. Report number SMRUC-MSS-2017-005. <https://data.marine.gov.scot/node/931/revisions/5706/view>, (accessed 10 December 2017), at 10

[44] Russell D.J.F and others, (2014) 'Marine mammals trace anthropogenic structures at sea', Current Biology, 24, 638

[45] Hastie G.D., and others, (2015) 'Sound exposure in harbour seals during the installation of an offshore wind farm: predictions of auditory damage' Journal of Applied Ecology, 52, 631

[46] Tougaard J., Henriksen O.D., Miller L.A., (2009) 'Underwater noise from three types of offshore wind turbines: estimation of impact zones for harbour porpoises and harbour seals', Journal of the Acoustical Society of America, 125, 3766

[47] Dyndo M., and others, (2015) 'Harbour porpoises react to low levels of high frequency vessel noise' Nature Scientific Reports, 1, 4

[48] Brandt and others, (n28), 176

The placement of OWFs may cause physical injuries or directly affect animal survival if marine mammals happen to collide with the sub-structures of offshore wind turbines. Alternatively, operational OWF may result in indirect negative impacts where multiple turbines create a barrier effect resulting in chronic disruption of animal behaviour. This effect occurs when marine mammals purposively avoid development areas during the operational phase. Indirect impacts on marine mammals are extremely complex to detect and quantify.

Harwood and King (2017) argue that permanent threshold shift (PTS) or temporary hearing shift (TPS) may directly affect the survival of animals if it reduces their capacity to escape their predators.[49] On the other hand, experiencing PTS or TPS may also indirectly affect their ability to survive and reproduce by altering the animal's ability to locate its mate or to detect and capture prey.[50] Further, acoustic disturbances or barrier effects from operating turbines may prompt chronic disruption of animal behaviour if animals are displaced from critical habitats in order to avoid the OWF area.[51] Displacement effects associated with avoidance behaviour may have population-level consequences on species if they result in increased stress levels and reduced energy budget for foraging, breeding and reproduction. A species population decline is likely to occur if the vital rates of a sufficient number of animals are affected.[52] In a similar vein, displacement may also result in reduced foraging opportunities if animals are displaced to areas with lower foraging quality or where there is increased competition.[53]

[49] Harwood and King, (n43), 9
[50] Ibid.
[51] Harwood J., and others, (2016) 'Understanding the Population Consequences of Acoustic Disturbances for Marine Mammals' in Popper A.N., Hawkins A., eds. *The Effect of Noise on Aquatic Life II* (New York, Springer, 2015), 418
[52] Vital rates refer to 'all components of animals' fitness' which include their capacity to survive, reproduce and breed in a particular year. See further: Harwood and others, (n51), 419
[53] Russell and others, (n34), 1649

Conversely, the installation of OWFs may come with indirect positive impacts. Colonisation of turbine foundations and scour protections by epifauna is commonly associated with an increase in prey availability for top predators such as cetaceans and seals attracted by foraging opportunities.[54] Recent evidence has shown that foraging harbour seals and grey seals were attracted by the artificial reef effect of turbines foundations.[55] There is however a risk that anthropogenic noise and vibration from pile-driving, maintenance vessels or operating turbines indirectly affect marine mammals by relocating their prey.[56] Changes in abundance and distribution patterns for almost all cetacean species have been attributed to a reduction in pelagic biomass or changes in prey species composition.[57] This may potentially cause increased stress levels in marine mammals as well as additional energy costs to capture their prey with associated negative consequences on foraging success, reproduction and breeding activities.[58]

Marine mammals are also known to use the Earth's magnetic fields to navigate over long distances. Marine mammals are thus sensitive to local interferences in magnetic fields from subsea cables. Potential effects of electro-magnetic fields may increase the risk of marine mammals beaching due to navigational errors as well as additional energy expenditure associated with longer detours in migration routes. Knowledge in this field is highly limited.

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[54] Scheidat M., and others, (2011) 'Harbour porpoises (*Phocoena phocoena*) and wind farms: a case-study in the Dutch North Sea', Environmental Research Letters, 6(2), 1, 9

[55] Russell and others, (n34), 1643, 1648: See further: Russell and other, (n44), 638

[56] Culloch R.M., and others, (2016) 'The effects of construction related activities and vessel traffic on marine mammals', Marine Ecology Progress Series, 549, 231

[57] Nottestad L., and others, (2015) 'Recent changes in distribution and relative abundance of cetaceans in the Norwegian Sea and their relationship with potential preys' Frontiers in Ecology and Evolution, 2, 1

[58] Thompson P.M., and others, (2013) 'Framework for assessing impacts of pile driving noise from offshore wind farm construction on a harbour seal population', Environmental Impact Assessment Review, 43, 73

2.2. Seabirds

A number of seabird species are listed under the Birds Directive[59] and as such, these are subject to special protection measures for their survival and reproduction in their area of distribution.[60] Among these species, the common guillemot, red-throated diver, the sandwich tern, the Manx shearwater and the common terns come under the protection regime of the Birds Directive (see further Chapter IV).

OWFs are associated with three types of adverse effects on seabirds: 1) displacement and barriers to flight movement with higher energy costs and adverse effects on survival and breeding success, 2) loss of functional habitat as a result of avoidance behaviour and 3) mortalities from collision risks.[61] Risks of adverse impacts on seabirds are particularly high during the operational phase.[62] Operational OWFs may affect birds through collision mortality and barrier effects.[63] Barrier effects occur where sea birds are forced to extend their flight trajectories or migration routes to avoid OWFs and reach their colonies or foraging areas.[64]

The impacts of OWFs on avian populations are highly species-specific.[65] Collision risks depend on the flight altitude of species: seabirds flying at greater height may experience greater risk of collision with rotating blades.[66] Collision risks are also more likely to occur when seabirds exhibit low-avoidance behaviours or directly fly through

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[59] Directive 2009/147/EC of 30 November 2009 on the conservation of wild birds (Birds Directive) [2009] OJ L20/7

[60] Birds Directive, Article 4(1)

[61] Danish Offshore Wind, (n35), 95

[62] Bailey, Brookes and Thompson, (n22), 3

[63] Furness R.W., Wade H.M., Masden E.A., (2013) 'Assessing vulnerability of marine bird population to offshore wind farms', Journal of Environment Management, 119, 56

[64] Masden E.A., and others, (2010) 'Barriers to movement: Modelling energetic costs of avoiding marine wind farms amongst breeding seabirds', Marine Pollution Bulletin, 7, 1085

[65] Dierschke R., Furness R., Garthe S., (2016) 'Seabirds and offshore wind farms in European waters: Avoidance and attraction', Biological Conservation, 202, 59, 60

[66] Furness, Wade and Masden, (n63), 57

OWFs (micro-avoidance).[67] The design of offshore wind turbines has been found to have significant implications for collision risks, with potentially lower collisions risks as the hub height and turbine diameter increase.[68]

Evidence of attraction responses to turbines has been reported for cormorants (*Phalacrocorax carbo),* the European shag (*Phalacrocorax aristotelis*) and other species of gulls.[69] Monitoring findings at Horns Rev II OWF indicate that a number of gull species such as herring gulls (*Larus argentatus*), common gulls (*Larus canus*) and great black-backed gulls (*Larus marinus*) show no avoidance at all.[70] The ‘ecological incentives’ behind the attraction of birds have been attributed to the use of the turbines for resting, roosting and feeding.[71] Increases in prey availability encouraged by the artificial reef effects of offshore turbines are also reported to attract foraging seabird species.[72] In Belgian OWFs, lesser black-backed gulls (*Larus fuscus*) and black-legged kittiwakes (*Rissa tridactyla*) for example, were seen to forage on pelagic prey between the turbines and on the epifauna on accessible jacket foundations.[73]

Conversely, the placement of OWFs may create a barrier effect to the movement of migrating and breeding seabirds if birds exhibit strong avoidance behaviours (see below). Evidence collected through radar surveys, infra-red videos and visual

[67] Cook A.S.C.P. and others, (2012). A Review of Flight Heights and Avoidance Rates for Birds in Relation to Offshore Wind Farms. Report by British Trust Ornithology, 61pp. <https://tethys.pnnl.gov/publications/review-flight-heights-and-avoidance-rates-birds-relation-offshore-wind-farms> (accessed 20 April 2017), at 11-15

[68] Johnston A., and others, (2014) ‘Modelling flight heights of marine birds to more accurately assess collision risks with offshore wind turbines’ Journal of Applied Ecology, 51, 31

[69] Dierschke, Furness and Garthe, (n65), 60, 66

[70] Petersen, I.K., Nielsen, R.D. & Mackenzie, M.L. (2014). Post-construction evaluation of bird abundances and distributions in the Horns Rev 2 offshore wind farm area, 2011 and 2012. Report commissioned by DONG Energy. Aarhus University, DCE – Danish Centre for Environment and Energy. 51pp. <http://birdlife.se/wp-content/uploads/2019/01/Bird-abundances-and-distributions_Evaluation_Horns_Rev_2.pdf > (accessed 26 November 2016), at 27-31

[71] Vanermen N., and others, (2015) ‘Seabirds avoidance and attraction at an offshore wind farm in the Belgium part of the North Sea’, Hydrobiologia, 756(1), 51, 57

[72] Dierschke, Furness and Garthe, (n65), 66

[73] Vanermen and others, (n71), 58

observation at Thorntonbank,[74] (Belgium), Egmond aan Zee (The Netherlands),[75] Robin Rigg[76] (United-Kingdom), Horns Rev I and Nysted,[77] and Horns Rev II[78] (Denmark) suggest that seabirds generally avoid the vicinity of OWFs. Strong avoidance behaviour has been observed for northern gannets (*Morus Bassanus*), common scoters (*Melanitta nigra*), red-throated divers (*Gavia stellata),* sandwich terns (*Sterna sandvicensis)*, Manx shearwaters (*Puffinus puffinus*), common guillemots (*Uria aalge*), razorbills (*Alca Torda*), and long-tailed ducks (*Clangula hyemalis*).[79] Vanermen *et al*., (2017) demonstrate that northern gannets (*Morus bassanus*), common guillemots (*Uria aalge*) and razorbills (*Alca torda*) significantly avoided the vicinity of the Bligh Bank and Thorntonbank wind farms areas.[80] Aerial surveys around Egmond aan Zee and Greater Gabbard OWFs[81] and OWF developments in the German Bight similarly confirm that northern gannets tend to avoid the areas where wind farms are installed.[82] Monitoring findings may be highly inconsistent among individuals of a same species depending on the configuration of OWFs.[83] In other locations, species of gulls (lesser-black backed

[74] Vanermen N., and others, (2017). Sea-bird Monitoring at the Thorntonbank offshore wind farms – Updated seabird displacement results and an explorative assessment of large gull behavior inside the wind farm area. (31). Instituut voor Natuur- en Bosonderzoek, Brussel. 44pp.

[75] Krijgsveld K., and others, (2011). Effects Studies Offshore Wind Farm Egmond aan Zee. Final Report on Fluxes, Flight Altitudes and Behaviour of Flying Birds. Report by Bureau Waardenburg bv, IMARES-Wageningen UR and Noordzeewind, 334pp. <https://tethys.pnnl.gov/publications/effect-studies-offshore-wind-farm-egmond-aan-zee-final-report-fluxes-flight-altitudes> (accessed 12 September 2016)

[76] Walls R., and others, Analysis of marine environmental monitoring plan data from the robin rig offshore wind farm, Scotland (Operational year 1). Report by E. ON and Natural Power; 2013: p.210

[77] Petersen I.K., and others, (2006) Final results of bird studies at the offshore wind farms at nysted and horns rev. Denmark: Report by DONG Energy, National Environmental Research Institute (NERI), and Vattenfall A/S; 2006: 166pp. <https://tethys.pnnl.gov/publications/final-results-bird-studies-offshore-wind-farms-nysted-and-horns-rev-denmark> (accessed 12 May 2017), at 150

[78] Petersen, Nielsen and Mackenzie, (n70), at 27-31

[79] Dierschke, Furness and Garthe, (n65), 61; Vanermen and others, (2015), (n71), 55; Vanermen and others, (2017), (n74), at 21, 26, 35; Petersen and others, (n77), at 147

[80] Vanermen and others, (n74), at 21, 26

[81] Skov H., and others, (2018). ORJIP Bird Collision and Avoidance Study Final Report April 2018 (The Carbon Trust, United Kingdom), 247pp. <https://tethys.pnnl.gov/sites/default/files/publications/Skov-et-al-2018.pdf> (accessed 18 September 2018), at 105

[82] Garthe S., Markones N., Corman A.M., (2017) 'Possible impacts of offshore wind farms on sea birds: a pilot study in Northern Gannets in the South North Sea' Journal of Ornithology, 158 (1), 345

[83] Thaxter C.B., and others, (2015) 'Seabird-wind farm interactions during the breeding season very between years: a case study of lesser black-backed gull Larus fuscus in the UK', Biological Conservation, 186, 347

gull) did not exhibit any displacement or attraction behaviours.[84] Leopold *et al.*, (2013) emphasised that for many species, displacement/collision could not be established uniformly between Belgian OWFs.[85] Northern gannets and common guillemots for example, were seen to exhibit stronger avoidance around the Prinses Amalia Wind Park (PAWP) than in Egmond aan Zee due to the lower density of turbines at Egmond aan Zee.[86] Avoidance responses at PAWP were also found for Black-legged Kittiwake and Razorbill, whereas for Egmond aan Zee, avoidance was only found for divers, the Great Crested Grebe and Common Scoter.[87]

Seabirds may experience a loss of functional habitats as a result of macro-avoidance behaviours.[88] Macro-avoidance typically occurs when birds completely avoid OWFs by flying around or over them, thus increasing their energy costs.[89] In the case of breeding/migratory seabirds, increased times and costs associated with additional flight journey may alter species population demographic rates by reducing energy budgets available to forage, reproduce and breed.[90] Seabirds are particularly vulnerable to displacement during breeding seasons. Breeding seabirds are 'central place foragers' which mean that they are spatially constrained to travel between their breeding colonies and foraging places.[91] There is a limit to how far breeding seabirds can travel from the colony to forage: beyond a certain distance from nests, seabirds will be unable to bring

[84] Thaxter C.B., and others, (2018) 'Dodging the blades: new insights into three-dimensional space use of offshore wind farms by lesser-black backed gulls *Larus fuscus*', Marine Ecology Progress Series, 587, 247
[85] Leopold M., Van Bemmelen R., Zuur A., (2013). Responses to Local Birds to the Offshore Wind Farm PAWP and OWEZ off the Dutch mainland coast. Report by IMARES – Wageningen UR., 108pp. <https://tethys.pnnl.gov/publications/responses-local-birds-offshore-wind-farms-pawp-and-owez-dutch-mainland-coast> (20 March 2017), at 98-99
[86] Ibid, 99
[87] Ibid
[88] Garthe, Markones and Corman, (n82), at 347
[89] Furness, Wade and Masden, (n63), 56
[90] Warwick-Evans V., and others, (2017) 'Predicting the impacts of offshore wind farms on seabirds: An individual-based model', Journal of Applied Ecology, 55(2), 503
[91] Masden and others, (n64), 1085

food back to their offspring and hence, breed successfully.[92] Breeding seabirds are therefore more energetically sensitive to displacement and barrier effects of OWFs. Additional energetic costs resulting from increased flight distances may reduce the mass and body conditions of seabirds.[93] Masden *et al.*, (2009) explain that alteration of body conditions will in turn have detrimental effects on reproductive output and, or breeding success of a colony.[94] While travel costs caused by avoidance of a single OWF may be marginal,[95] the cumulative energy expenditure associated with avoiding multiple OWFs may significantly increase the risk of population impacts.[96]

2.3. Fish and benthic communities

The impacts of OWFs on demersal fish species and benthic communities are regarded as both positive and negative.[97] Construction activities such as drilling, piling, and cable-laying will temporarily disturb the seabed by causing sediment particles to re-suspend. Seabed disturbance leads to direct mortalities of benthic animals living in sediments (infauna) and on seabed (epifauna).[98] Seabed disturbance will further cause mobile species to leave the area, while mortality of sessile species may occur due to smothering (i.e. burial under fallouts of sediments).[99]

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[92] Scottish National Heritage, (2018). Interim Guidance on Apportioning Impacts from Marine Renewable Energy Developments to Breeding Seabirds in Spatial Protection Areas. 12pp. <https://www.nature.scot/interim-guidance-apportioning-impacts-marine-renewable-developments-breeding-seabird-populations> (14 April 2019), at 2

[93] Masden and others, (n64), 1085

[94] Ibid.

[95] Masden E.A., and others, (2009) 'Barriers to movement: impact of wind farms on migrating birds', ICES Journal of Marine Science, 66(4), 746, 751

[96] Bush M.A., and others, (2013) 'Consequences of a cumulative perspective on marine environmental impacts: Offshore wind farming and seabirds at North Sea scale in context of the EU marine strategy framework directive', Ocean and Coastal Management, 71, 213

[97] Bergström L., and others, (2014), 'Effects of offshore wind farms on marine wildlife- a generalized impact assessment', Environmental Research Letters, 9(3), 1

[98] Miller R.G., and others, (2013) 'Marine renewable energy development: assessing the Benthic Footprint at multiple scale', Frontiers in ecology, 11(8), 433

[99] Ibid, 436-437

The main impact resulting from the introduction of hard substrates and scour protection is the introduction of completely different faunal communities to those that occurred prior to construction.[100] The introduction of turbine foundations and scour protection made of gravel and stones to secure turbine foundations in the seabed encourages the development of epifauna where native infaunal species initially predominated.[101] Another source of concern includes the potential impacts on benthic animals of operational noise (turbine vibration) and electromagnetic fields (EMF). Cables transmitting electricity to sub-stations and onshore installations will emit EMF that may affect the movement and navigation of invertebrates and certain fish species. EMF originates from both inter-turbines cables (collection system) and export cables. These two types of cables generate different EMF emissions and as such, may prompt different responses by marine animals.[102] AC power transmission cables directly emit magnetic field (B-field) and induced electric fields (E-field) associated with the electric production.[103] The interferences caused by EMF may: 1) disturb navigation and migration by creating a non-visual barrier on navigation routes; 2) alter important ecological functions such as prey detection for electro-sensitive species; 3) engender short-term behavioural responses and movement such as attraction or avoidance; and 4) provoke adverse physiological disturbances (hormonal disturbances, developmental delays of eggs and larvae).[104] To date, responses to EMFs have been found for invertebrates (bivalves, cephalopods), bony fish, elasmobranches (shark, rays and

[100] Leonhard SB., Pedersen J., (2006). Benthic communities at Horns Rev before, during and after construction of horns rev offshore wind farm: final report. Report by Bioconsult and Vattenfall A/A, p.134. <https://tethys.pnnl.gov/publications/benthic-communities-horns-rev-during-and-after-construction-horns-rev-offshore-wind> (accessed 8 May 2017), at 7, 29

[101] Andersson M., Öhman M., (2010) 'Fish and sessile assemblages associated with wind turbine constructions in the Baltic Sea', Marine and Freshwater Research, 61(6), 642

[102] Gill A.B., and others, (2014). 'Marine renewable energy, electromagnetic field s and EM-sensitive animals' in Shields M., Payne A.I.L. (eds.) *Marine Renewable Energy Technology and Environmental Interactions* (Springer, Dordrecht, 2014), 68,71

[103] Gill A.B., Bartlett M., Thomsen F., (2012) 'Potential interactions between diadromous fishes of UK conservation importance and the electromagnetic fields and subsea noise from marine renewable energy developments', Journal of Fish Biology, 81, 664

[104] Snoek R., and others, (2016), The potential effects of electromagnetic fields in the Dutch North Sea. Phase 1: Desk Study. Final Report by Water Proof Marine Consultancy & Research BV. and Bureau Waardenburg bv, at 48, 51

skates), crustaceans (lobster, prawns), marine mammals and turtles.[105] These taxonomic groups are known to use electric and magnetic fields for hunting, navigation and spatial orientation.[106] Snoek *et al*., (2016) have shown that some species of invertebrates, elasmobranches and bony fish, in some cases, show attraction or avoidance reactions to subsea power cables.[107] Minor impacts have also been detected on migratory patterns of eels.[108] As the main source of EMF results from submarine cables, benthic and demersal species are more likely to be adversely exposed to high field strengths than pelagic species.[109]

There is currently a lack of research addressing the direct and indirect impacts of underwater noise on fish and shellfish species. Similar to marine mammals, pulsed sounds from pile-driving and vibration noise generated by operational turbines may increase stress levels in fish, mask their communications/orientation signals and potentially reduce reproduction and foraging success as well as migration activities.[110] With respect to the operational phase, Wahlberg and Westerberg (2005) explain that underwater noise may decrease the effective range for sound communication of fish.[111] In a similar vein, benthic invertebrates are likely to suffer from tissue injuries as a result of exposure to pile-driving noise.[112] There is some evidence showing fish and shellfish

[105] Normandeau Exponent, T. Tricas and A. Gill (2011). Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Regulation, and Enforcement, Pacific OCS Region, Camarillo, CA. OCS Study BOEMRE 2011-09. <https://tethys.pnnl.gov/publications/effects-emfs-undersea-power-cables-elasmobranchs-and-other-marine-species> (accessed 5 April 2017) , at 4-6, 29,50
[106] Gill and others, (2014), (n102), 69
[107] Snoek and others, (n104), at 45-48
[108] Öhman M.C., Sigray P., Westerberg H., (2007) 'Offshore windmills and the effects of electromagnetic fields on fish', AMBIO, 36(8), 630
[109] Gill and others, (2014), (n102), 61
[110] Bergström L., Sundqvist F., Bergström U., 'Effects of offshore wind farms on temporal and spatial patterns in the demersal fish community' (2013) 485 Marine Ecology Progress Series, 199, 200
[111] Wahlberg M., Westerberg H., (2005) 'Hearing in fish and their reaction to sounds from offshore wind farms', Marine Ecology Progress Series, 288, 295
[112] Hawkins, A. D., Pembroke, A. E., and Popper, A. N., (2015) 'Information gaps in understanding the effects of noise on fishes and invertebrates', Reviews in Fish Biology and Fisheries, 25(1), 39

reactions to impulsive sounds.[113] Andersson (2011) found that pile driving noise resulted in behavioural reactions in cod (*Gadus morhua*) and sole (*Solea solea*) occurring up to 70 km from the piling source.[114] Mueller-Blenke *et al*. (2010) have also provided evidence of avoidance responses to pile-driving sound through increased swimming speed and freezing responses in sole.[115] De Soto (2013) provides evidence that noise from seismic surveys cause significant development delays and body abnormalities in larvae.[116] They conclude that if larvae are subject to intense noise exposure during their development, this could reduce their recruitment and have a delayed impact on stocks of mature animals.[117] Some studies have shown that marine crustaceans detect, produce and respond to underwater noise, but crustacean sound sensitivity would be restricted to particle motion.[118] Evidence of short-term colonisation of epibenthos and increased fish biomass after construction nevertheless have led some scientists to conclude that sounds generated by operating turbines would not have major adverse effects on fish and benthic organisms, attracted by foraging opportunities, shelter and protection.[119]

Positive effects refer to the enhancement of habitats complexity and increased local biodiversity enabled by the artificial-reef effect of turbines foundations and associated

[113] Gill, Barlett and Thomsen, (n103), 664
[114] Andersson M., (2011). Offshore Wind Farms- Ecological Effects of Noise and Habitat Alteration on Fish. Doctoral Dissertation, Stockholm University. 49pp. <https://tethys.pnnl.gov/publications/offshore-wind-farms-ecological-effects-noise-and-habitat-alteration-fish> (accessed 12 December 2016), 28
[115] Mueller-Blenkle C., and others, (2010). Effects of pile-driving noise on the behaviour of marine fish. COWRIE Ref: Fish 06-08, Technical Report 31st March 2010. 57pp. <https://dspace.lib.cranfield.ac.uk/handle/1826/8235> (accessed 15 November 2016), at 27
[116] De Soto N.A., and others, (2013) ‘Anthropogenic noise causes body malformations and delays development in marine larvae’, Scientific Reports, 2831, 1
[117] Ibid, at 2
[118] Edmonds N., and others, (2016) ‘A review of crustacean sensitivity to high amplitude underwater noise: Data needs for effective risk assessment in relation to UK commercial fisheries’, Marine Pollution Bulletin, 108 (1) -(2), 5
[119] Lindeboom H.J., and others, (2011) ‘Short-term ecological effects of an offshore wind farm in the Dutch coastal zone; a compilation’, Environmental Research Letters, 6:035101, 1, 8; Leonhard and Pedersen, (n100), 80

scour protections.[120] Turbine foundations may create positive effects on fish and benthic communities through the combined effects of trawling restriction/exclusions and the artificial reef effects resulting from the introduction of hard substrate in marine waters.[121] A number of scientific papers provide examples of artificial reefs and associated positive 'attraction-production' processes on local biodiversity.[122] In Belgium, Denmark, the Netherlands and the United Kingdom, monitoring of benthic communities around turbine foundations and scour protection has shown increased biomass of epifaunal species such as edible crabs (*Cancer pagarus*), barnacles (*Balanus improvisus*) and blue mussels (*Mytilus edulis).*[123] However, these effects are rarely consistent between OWFs due to different time-scales and sampling techniques used in monitoring studies.[124] The colonisation of epifaunal species depends on a number of site-specific criteria including water depth, salinity, turbidity, sandbank topography, fishing pressure and foundation type used.[125] As the literature suggest, it will take five years before there are stable faunal communities around new hard substrates.[126] Despite this, colonisation of epifauna seems to be a common pattern in all OWF developments.[127] Horns Rev I was described as a potential sanctuary area for two

[120] Bergström, Sundqvist and Bergström, (n110), 199
[121] Langhamer O., (2012) 'Artificial Reef Effect in relation to Offshore Renewable Energy Conversion: State of the Art', The Scientific World Journal, 386713, 8, 2-3
[122] Krone R., and others, 'Mobile demersal megafauna at common offshore wind farm foundations in the German Bight (North Sea) two years after deployment –increased produced rate of *Cancer pagurus*' (2017) 123 Marine Environmental Research, 53; Stenberg C., and other, (2015) 'Long-term effects of an offshore wind farm in the North Sea on fish communities', Marine Ecology Progress Series, 528, 257; Bergström and others, (n97), 202-206
[123] Krone and others, (n122), at 53-61; Leonhard and Pedersen, (n100), 50-52; Wilhelmsson D., Malm T., 'Fooling assemblages on offshore wind power plants and adjacent substrata' (2008) 79 (3) Estuarine, Coastal and Shelf Science, 459; Maar M., and others, Local effects of blue mussels around turbine foundations in an ecosystem model of Nysted off-shore wind farm (2009) 62 Journal of Sea Research, 159
[124] Vandendriessche S., Derweduwen J., (2015) 'Equivocal effects of offshore wind farms in Belgium on soft substrate epibenthos and fish assemblages', Hydrobiologia, 756(1), 19
[125] Ibid, 31
[126] Ibid, 29
[127] Lindeboom and others, (n119), at 5

threatened or red list epifauna species, the Ross worm (*Sabellaria spinulosa*) and the white weed (*Sertularia cupressina*).[128]

Increased biomass in epifaunal assemblages in turn attracts larger fish species and lead to enhanced foraging opportunities for top predators including marine mammals and seabirds.[129] Many environmental studies reveal an increase in biomass of commercial bentho-pelagic, semi-demersal and demersal fish species in the vicinity of European OWFs.[130] Leonhard and Pedersen stress that a relationship exists between food availability and an observed increase of 7% of total fish biomass within Danish OWFs.[131] Further, seven years after construction, Stenberg *et al.*, (2015) indicate that the artificial reef effect of Horns Rev I OWF was 'large enough to attract key fish species with a preference for rocky habitats' such as whiting (*Merlangius merlangus*) and, sand eel (*Ammodytidae*) including some reef fish species which were previously absent from surrounding areas.[132] In a similar vein, Lindeboom *et al.*, (2011) estimated a significant increase of sole (*Solea solea*), whiting (*Merlangius merlangus*) and striped red mullet (*Mullus surmuletus*), indicating that Egmond aan Zee offshore wind turbines may act as fish-aggregating devices.[133]

Positive changes in biodiversity may nevertheless be outweighed by increased predation pressures from other foraging species[134] and redistribution of fishery efforts in adjacent areas. Even more so, foundations of offshore wind turbines have been found to be

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[128] Ibid, 29
[129] Reubens J.S., and others, (2014) 'The ecology of benthopelagic fishes at offshore wind farms: a synthesis of four years of research', Hydrobiologia, 727(1), 121
[130] Ibid; Wilhelmsson D, Malm T., Öhman M.C, (2006) 'The influence of offshore wind power on demersal fish', ICES Journal of Marine Sciences, 63(5), 775; Andersson M.H., Öhman M.C., (2010) 'Fish and sessile assemblages associated with wind-turbine constructions in the Baltic Sea', Marine and Fresh Water Resource, 61(6) 642; Stenberg and others, (n122), at 257, 264
[131] Leonhard and Pedersen, (n100), 82
[132] Stenberg and others, (n122), at 257, 264
[133] Lindeboom and others, (n111), 6
[134] Bergström and others, (n97), 200

conducive to non-native species.[135] Invasive species have been found to colonise a number of Danish and Belgian OWFs.[136] Leonhard and Pedersen (2006) estimate that of the 111 total invertebrate species observed during monitoring activities at Horns Rev I, only 37 species/taxons could be characteristically found as native fauna before the establishment of the OWF.[137] Ten non-indigenous species were also reported to use the foundations of a Belgian OWF to expand their range and strengthen their strategic position in the area.[138] According to Langhamer (2012), the spread of non-native species to OWFs constitutes an important threat to local biodiversity and may lead to local extinction of commercial fish species and, or changes in taxa in the entire recipient region.[139]

[135] Adams T.P., and others, (2014) 'Offshore marine renewable energy devices as stepping stones across biogeographical boundaries', Journal of Applied Ecology, 51, 330

[136] De Mesel I., and others, (2015) 'Succession and seasonal dynamics of the epifauna community on offshore wind farm foundations and their role as stepping stones for non-indigenous species', Hydrobiologia, 756(1), 37; Wilhelmsson D., Malm T., (2008) 'Fooling assemblages on offshore wind power plants and adjacent substrata', Estuarine, Coastal and Shelf Science, 79(3), 459

[137] Leonhard and Pedersen, (n100), 52-53

[138] De Mesel and others, (n136), 43

[139] Langhamer, (n121), 3

2.4. Physical environment and hydrodynamics

Three receptors are commonly considered when monitoring the impacts of OWFs on physical environment: 1) scours at turbine foundations, 2) suspended sediment concentration and 3) current/turbid wakes (see below).[140] Post-monitoring environmental data for 19 OWFs in the United-Kingdom have been compiled by the MMO providing a relevant evidence base on the effects of OWFs on hydrodynamics, sediment dynamics and seabed topography.[141] First and foremost, OWFs have been reported to disturb sedimentary seabed by causing sediment particles to re-suspend by the effect of scour development and in-water turbid wakes. Changes in sediment dynamics may engender both 'near-field' and 'larger-scale' 'far-field' effects on the marine biodiversity and the physical environment.[142] Near-field effects typically occur in the vicinity of the OWF, whereas 'far-field' dynamics occur outside OWFs. Far-field effects may generate adverse effects at the scale of an ecosystem by changing patterns of sediment deposition.[143] In the near-field area, local increased sediment concentration occurs as a result of temporary re-suspension of sediment plumes during pile-driving and cable-laying operations. Increased sedimentation also results from the vertical interaction of current and tidal flows with turbine foundations. Vertical interactions of flows cause sediments to re-suspend and erosion of the seabed immediately around turbine foundation. Scour therefore appears as holes at the bottom of turbine foundations due to the removal of sediment materials.[144] Scour can lead to a decrease in

[140] MMO, (2014) 'Review of post-consent offshore wind farm monitoring data associated with licence conditions', (n8), at 25
[141] Ibid, 25-44
[142] Clark S., Schroeder F., Baschek B., (2014), 'The influence of large offshore wind farms on the North Sea and Baltic Sea' (Helmholtz-Zentrum Geesthacht. Zentrum für Material- und Küstenforschung GmbH, HZG Report, 2014), 46pp. <https://tethys.pnnl.gov/publications/influence-large-offshore-wind-farms-north-sea-and-baltic-sea-comprehensive-literature> (accessed 12 December 2016), at 11
[143] Ibid.
[144] Whitehouse R.S and others, (2011), 'The nature of scour development and scour protection at offshore wind farm foundations', Marine Pollution Bulletin, 62(1), 73

local biodiversity as a result of oxygen reduction, increased turbidity and lack of visibility for representative species of diving seabird, marine mammals and fish.[145]

Re-suspended sediment plumes around structure foundations are redistributed by the wake effects of each monopile following the same directional patterns of currents up to several kilometres behind turbine foundations.[146] Satellite pictures acquired form Landsat 8 around London Array, Thanet and Great Gabbard OWFs have shown that in-water turbid wakes may extend up to 30-150 metres wide and typically stretch up several kilometres behind individual turbines.[147] At Thanet OWF, the extent of the wake exceeded 10 km.[148] These images also reveal a significant increase of suspended sediment concentration in the in-water wake of individual turbines. Vanhellemont and Ruddick (2014) explain that turbid wake effects could significantly alter hydrodynamic flows and sediment transport.[149] Hydrodynamics and sediment dynamics are known to support important ecological and physical processes including food web dynamics, nutrient cycling and distribution of larvae, juveniles and propagules.[150] Turbid wakes may have far-field consequences on sedimentary habitats which in turn, may influence the composition of benthic assemblages.[151] The impacts of turbid wakes on physical systems will however depend on sea-floor sediment types. Increased sedimentation most likely occurs where OWFs are installed on shallow sand banks.[152] Similar observations have been reported for other offshore wind sites in Germany, the

[145] Weiffen M., and others, (2006) 'Effect of water turbidity on the visual acuity of harbor seas' (Phoca vitulina), Vision Research, 46, 1777
[146] Vanhellemont Q., Ruddick K., (2014) 'Turbid wakes associated with offshore wind turbines observed with Landsat 8', Remote Sensing of Environment, 145, 105
[147] Satellite pictures of turbid wakes associated with London Array and Thanet Offshore wind farms can be found at: NASA, (2016). Offshore Wind Farms Make Wakes. <https://earthobservatory.nasa.gov/IOTD/view.php?id=89063> (last accessed 16 January 2018)
[148] Vanhellemont and Ruddick, (n146), at 112
[149] Ibid, at 110, 112
[150] Shields M.A., and others, (2011) 'Marine renewable energy: The ecological implications of altering the hydrodynamics of the marine environment', Ocean and Coastal Management, 54(1), 2
[151] Ibid.
[152] Vanhellemont and Ruddick, (n146), 110

Netherlands and Belgium, suggesting that in-water turbid wakes may be a general process associated with OWFs.[153] Although research suggests that changes in sediment dynamics will mostly be localised and limited to sedimentary seabeds, the combined wake effects of multiple large-scale wind farms on ecosystems should not be ignored.[154]

3 - Decommissioning

The decommissioning takes place when OWFs have reached the end of their design life. OWFs developers may be required under the licence conditions to submit decommissioning programmes (DP) for approval by the competent authority prior to commencing construction works. Information relating to the impacts of decommissioning and associated mitigation measures should be incorporated in initial EIA Reports[155] and, or Natura Impact Statements supporting applications for development consents. Decommissioning operations are not specifically referred to under the Habitats Directive. In many jurisdictions, DPs must however be subject to an appropriate assessment of the implications of decommissioning works for nearby Natura 2000 sites.[156] Since a new ecological system is likely to emerge on and around turbine foundations during the operational phase, this information will need to be reviewed before the start of decommissioning works. In some cases, a new environmental assessment or AA may be required by competent authorities. Pursuant to

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153 Forster R.M, (2017). The effect of monopile-induced turbulence on local suspended sediment patterns around UK wind farms: field survey report. An IECS report to the Crown Estate. April 2017 – quoted in: Vattenfall Wind Ltd, November (2017). Thanet Extension Offshore Wind Farm Preliminary Environmental Information Report Vol.2. Chapter 2 Marine Geology, Oceanography and Physical Processes.<https://corporate.vattenfall.co.uk/projects/wind-energy-projects/thanet-extension/documents/preliminary-environmental-information-report/> (accessed 10 December 2016), at 67

154 Clark, Schroeder and Baschek, (n142), 12, 25

155 EIA Directive (2014/ 52/EU), Article 5(1), Annex IV (5) (a)

156 Department for Business, Energy and Industrial Strategy, (2018) Decommissioning of offshore renewable energy installations under the Energy Act 2004: Guidance note for industry (7 February 2017)

the polluter-pays-principle, developers are responsible for bearing the costs of all decommissioning works.[157]

Decommissioning involves either the total or partial removal of all the elements of the OWF, whether offshore or onshore. Offshore elements include turbine towers, foundations, transition pieces connecting the lower part of the turbine to its foundation, scour materials, offshore substations and subsea cables (inter-array and export cables).[158] Where partially removed, turbine foundations are cut-off at or below the seabed level and the remainder (i.e. scour protection and buried cables) is left *in situ*. The United Nations Convention on the Law of the Sea (UNCLOS)[159] establishes a presumption in favour of total removal of offshore installations. Abandoned or disused offshore installations should be removed to ensure safety of navigation, taking into account any generally accepted international standards established in this regard.[160] The IMO Guidelines and Standards for the Removal of Offshore Installations and Structures[161] state that all abandoned or disused installations standing in less than 75 m of water and weighting less than 4000 tonnes in air should be entirely removed.[162] A similar rule applies to abandoned or disused offshore installations established on or after 1 January 1988 standing in less than 100 m water and weighting less than 4000 tonnes in air.[163] As soft law instruments of international law, these standards are not legally binding. However, they should be taken into account when a decision is made regarding the removal of ORE devices. To date, the average water depth of OWFs currently

[157] Ibid, 6, 36
[158] Topham E., MacMillan D., (2017) 'Sustainable decommissioning of an offshore wind farm', Renewable Energy, 102, 470
[159] United Nations Convention on the Law of the Sea (adopted 10 December 1992, entered into force 16 November 1994) 1833 UNTS 397 (UNCLOS)
[160] UNCLOS, Article 60(3)
[161] IMO Resolution A. 672 (16) (Geneva, 19 October 1989)
[162] IMO Resolution A. 672 (16), at 3
[163] Ibid.

installed or under construction is 27.5 m.[164] Existing OWF turbines should therefore be removed in their entirety. Although the entire removal of offshore installations is the general rule, partial decommissioning is allowed where full removal is not technically feasible or involves extreme costs or unacceptable risks to personnel or the marine environment.[165] The framework of the OSPAR Convention sets out a legal framework for decommissioning in the North East Atlantic. Under the OSPAR Decision 98/3, 'the dumping or leaving wholly or partly in place of disused offshore installations' is prohibited. The OSPAR Guidance on Environmental Considerations for OWF Developments provides that 'the removed components of a wind farm should generally be disposed of entirely on land'.[166] However, 'if the competent authority decides that a component of the wind farm should remain at the site (*e.g*. parts of the piles in the sea-bed, scour protection materials), it should be ensured that they have no adverse impact on the environment, the safety of navigation and other uses of the sea'.[167]

The ecological impacts of decommissioning will depend on chosen decommissioning options, i.e. partial or total removal. Here again, there is a requirement under the IMO Resolution that the chosen means of removal should not cause a significant adverse effect on living resources of the marine environment, especially threatened and endangered species.[168] A common decommissioning approach proposed by developers consists of removing all parts of monopiles by cutting the foundations at the seabed level or at 1 or 2m depth below mud lines.[169] Monopiles are then lifted and shipped to

[164] Wind Europe, (2018). The European Offshore Wind Industry: Key Trends and Statistics 2017. <https://windeurope.org/about-wind/statistics/offshore/european-offshore-wind-industry-key-trends-statistics-2017/> (accessed 2 February 2018), at 5
[165] IMO Resolution A. 672(16), at 3-4
[166] OSPAR, (2008). OSPAR Guidance on Environmental Considerations for Offshore Wind Farm Development (Reference Number 2008-3), para.93. <https://www.ospar.org/work-areas/eiha/offshore-renewables> (28 February 2017)
[167] Ibid.
[168] IMO Resolution A. 672 (16), at 3
[169] Statoil, (2014). Decommissioning Programme Sheringham Shoal (Document NUMBER: SC-00-NH-F15-00005). <http://sheringhamshoal.co.uk/downloads/Decommissioning%20Programme.pdf> (accessed

land for dislocation or re-use.[170] Scour protection is usually left *in situ* and different options are provided with respect to sub-sea cables depending on the depth at which they are buried. In general, buried export and inter-array cables will be left *in situ* to 1-2 m beneath the seabed to minimise risks of adverse effects on the seabed and benthic ecology. The considerable length of cable is usually advanced as the underlying reason to leave cables *in situ*.[171]

Ecological impacts of decommissioning activities will mainly arise from cutting-off and lifting operations associated with turbine foundations. The cutting-off and removal of monopile foundations are likely to result in significant seabed disturbances and temporary increases in sedimentation. Re-suspended sediments will affect water quality and reduce local biodiversity in the affected area. In both cases, the spatial scale of the affected seabed area is considered as similar to the area impacted during the construction phase.[172] The type of vessels used for decommissioning works can be floating cranes, standard jack-up vessels or a special type of offshore unit with stabilising legs.[173] These vessels have direct contact with the seabed for stabilisation and hence these will cause temporary disturbance to sediments and death of infaunal species. Cut-off operations and boat activities will also temporarily increase ambient noise pollution. Cut-off operations occur underneath the water surface using different methodologies. Diamond wire cutting or water jetting are the commonly preferred

5 March 2017), at 32; London Array Ltd, (2011). Decommissioning programme for London Array (Doc No: LAL-CEM-000253). <http://www.londonarray.com/decommissioning-programme/> (accessed 14 March 2017), at 19; RWE Npower Renewables Ltd, (2011). Decommissioning Strategy Gwynt y Môr Offshore Wind Farm Ltd (Doc GMOL-GM16-1603-EN-001019119-01). <https://www.innogy.com/web/cms/mediablob/en/3171308/data/3171562/1/rwe-innogy/rwe-innogy-uk/sites/wind-offshore/in-operation/gwynt-y-mr/English.pdf> (accessed 14 March 2017), at 30;

[170] Airtricity, (2007) Decommissioning programme – Greater Gabbard Offshore Wind Farm Project (Document 570000/403-MGT100-GGR-107).<http://sse.com/media/92981/GGOWL_DecommissioningProgramme.pdf> (accessed 16 March 2017), at 37

[171] RWE Npower Renewables Ltd, (n169), at 32; Airtricity, Decommissioning programme – Greater Gabbard Offshore Wind Farm Project, (n170), at 45

[172] Ibid.

[173] London Array Ltd, (n169), at 13; Statoil, (n169), at 32.

methods to cut foundations.[174] Wire cutting involves cutting through the monopile with steel cutting wire. Panjerc found that sound radiated from diamond wire cutting operations would not be discernible from ambient background sound levels during cutting operations.[175] Consequently, the impact of acoustic noise from cutting operations is considered as having low potential for disturbance to marine species due to its temporary nature.[176] In the absence of further empirical data from decommissioned OWFs, such conclusions cannot be relied upon as best scientific knowledge. It is however likely that noise levels arising from decommissioning will generally be less damaging than decommissioning operations for oil and gas platforms, which routinely uses detonating explosives to fully remove or topple oil and gas platforms.[177] No explosive systems have been reported in the accessed decommissioning programmes for offshore wind turbines.

The cutting-off of turbine foundations will result in a direct loss of introduced habitats causing a reduction of local biodiversity, specifically the epifaunal and infaunal species that may have colonised turbine foundations and surrounding seabed areas. Loss of benthic ecology may represent a reduction in available prey for top predators. Potential adverse effects on local biodiversity will depend on the ecological performance of an OWF. Where an OWF is reported as 'ecologically performing', cutting-off turbines to their foundations above the seabed may be considered as the preferable removal option in order to minimise disturbance to marine habitats and faunal communities that may have colonised the areas. The so-called 'rig-to-reef' programme for oil and gas

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[174] Topham and MacMillan, (n158), 475

[175] Panjerc T., and others, (2016) 'Underwater sound measurement data during diamond wire cutting: First description of radiated noise', Proceedings of Meetings on Acoustic, 27(1), 1, 9

[176] Vattenfall Wind Power Ltd., (2017). Offshore Wind Farm. Preliminary Environmental Report. Vol.2 Chapter 7 Marine Mammals. Available at <https://corporate.vattenfall.co.uk/projects/wind-energy-projects/thanet-extension/documents/preliminary-environmental-information-report/> (accessed 20 November 2016), at 8

[177] Claisse J.T., and others, (2015), 'Impact from Partial Removal of Decommissioned Oil and Gas Platforms on Fish Biomass and Production of the Remaining Platform Structure and Surrounding Shell Mounds', PLoS ONE, 10(1), 1

infrastructures may be a potential practice transferrable to the OWF industry.[178] Similar 'renewable-to-reef' programmes could be developed towards the end of life of an OWF to enhance habitats for species of conservation importance or increase/maintain stocks of commercially important foraging demersal fish species.[179] Such practices could be incorporated into an adaptive management plan in compliance with the London Convention and Protocol Guidelines for the Placement of Artificial Reefs[180] and OSPAR Guidelines on Artificial Reefs in Relation to Marine Living Resources.[181]

4- Ecological footprints of ocean energy projects current empirical evidence

4.1. General considerations

Less is known about the impacts of wave and tidal energy devices on the surrounding marine environment. Ocean renewable energy technologies, except tidal energy, are still in development at Research & Development to pre-commercial stage. Data collection is on-going around single devices and small arrays of devices including SeaGen (Northern Ireland), Cape Sharp (Canada), Meygen (Scotland), Cobscook Bay Tidal Energy Project (United-States) as well as in the ocean testing facilities of the Fundy Ocean Research Centre for Energy (FORCE, Canada) and the European Marine Energy Centre (EMEC, Scotland).[182]

Stressor-receptor interactions associated with wave and tidal energy converters are relatively similar to stressor-receptor interactions associated with OWFs. The main stressors include collision risks for diving seabirds, marine mammals and fish with

[178] Smyth K., and others, (2015) 'Renewable-to-reefs– Decommissioning options for the offshore wind power industry', Marine Pollution Bulletin, 90(1) -(2), 247
[179] Ibid.
[180] London Convention and Protocol/UNEP Guidelines for the Placement of Artificial Reefs (UNEP Regional Sea Reports and Studies n187, IMO, 2009)
[181] OSPAR, OSPAR Guidelines on Artificial Reefs in relation to Living Marine Resources (Bonn, March 2012)
[182] Copping and others, 'Annex IV 2016 State of Science Report', (n9), at 31-34, 41-42

structures and mooring lines,[183] attraction/repulsion of fish and invertebrates to structures and subsea cables, noise pollution as well as energy removal and changes in flow dynamics.[184] Some general conclusions can be drawn from the existing knowledge base.

4.2. Physical environment and benthos

Wave and tidal energy devices are attached to the seabed either with gravity foundations, piled into the sea floor or by anchoring solutions.[185] The placement of devices has the potential to create changes in the local ecosystem by altering the physical environment in which they are introduced.[186] The physical environment includes the water column, seabed, water quality, hydrodynamics (flows) and sediment dynamics. Similar to OWFs, the introduction of devices into marine waters may cause near-field and far-field effects on hydrodynamics (tidal flow, wave height) and sediment transport.

The vertical interaction of flows with operating devices will inevitably affect benthic communities in the immediate vicinity of each device by re-suspending sediment plumes and removing of infaunal communities.[187] Near-field impacts will be characterised by alteration of benthic habitats and changes to benthic assemblages (from infauna to epifauna) within the construction footprint of devices and their cabling

[183] Furness R.W., and others, (2012) 'Assessing the sensitivity of seabird populations to adverse effects from tidal stream turbines and wave energy devices, ICES Journal of Marine Science, 69(8), 1466
[184] Copping and others, (n182), at 10-20
[185] Ibid, 129
[186] Baring-Gould E., and others, (2016). A Review of the Environmental Impacts for Marine and Hydrokinetic Projects to Inform Permitting: Summary Findings from the 2015 Workshop on Marine and Hydrokinetic Technologies, Washington, D.C. Report by H.T. Harvey & Associates, Kearns & West and National Renewable Energy Laboratory (NREL). 70pp. <https://tethys.pnnl.gov/publications/review-environmental-impacts-marine-and-hydrokinetic-projects-inform-regulatory> (accessed 20 October 2017)
[187] O' Carroll J.P.J., Kennedy R.M., Savidge G., (2017a) 'Identifying relevant scales of variability for monitoring epifaunal reef communities at a tidal energy extraction site', Ecological Indicators, 73, 388

routes.[188] The placement of wave and tidal energy devices will first adversely affect benthic species at the localised scale of devices and then act as stepping stones attracting colonising species which will be different to infaunal assemblages occurring on surrounding substrates.[189]

The interactions of wave energy converters and tidal turbines with water bodies are expected to come with different far-field effects.[190] Wave energy converters extract energy from wave actions. The placement of multiple converters may alter the energy of wave propagation and as such, potentially affect shoreline erosion.[191] Tidal energy converters capture energy from tidal currents, causing potential changes in flow dynamics and associated physical processes including sediment transport. An important source of environmental impacts associated with tidal energy systems concern the far-field effects of these technologies on benthic communities (infauna and epifauna), plants and other marine organisms that rely on flow dynamics for the transport of nutrients, dissolved gases, foods, and larval/juvenile and propagule dispersion.[192] Extraction of large amounts of energy from flow dynamics will result in a reduction in velocity which may cause a fragmentation of marine habitats and changes in sediment deposition.[193] Copping *et al*., (2016) further stress that changes in hydrodynamics will also result in modification of the mixing and water column stratification processes that could in turn, affect primary production and marine food chains.[194]

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188 Roche R.C., and others, (2016) 'Research priorities for assessing potential impacts of emerging marine renewable energy technologies: Insights from developments in Wales (UK)', Renewable Energy, 99, 1327, 1333

189 Ibid.

190 Copping A., (2018) The State of Knowledge for Environmental Effects. Driving Consenting/ Permitting for the Marine Renewable Energy Industry. Report by Pacific Northwest National Laboratory (PNNL). 25pp. <https://www.ocean-energy-systems.org/news/oes-publishes-a-position-paper-the-state-of-knowledge-for-environmental-effects/> (accessed 18 March 2018), at 6

191 Ibid.

192 Shields and others, (n150), at 5-7

193 Ibid, 6

194 Copping and others, (n182), at 16

Data collected at SeaGen indicate that there were no negative changes on benthic communities and show patterns of colonisation of the structure by blue mussels (*Mytilus edulis*).[195] A more recent study indicates that the effects of the SeaGen turbine on the structure and integrity of the benthos were found to be locally restricted to 16m around the bottom of the turbine.[196] Spatial patterns in epifaunal community structure and integrity were found to be significantly more variable in the immediate vicinity of the turbine, within the rotor diameter.[197] These effects were not seen beyond this perimeter and therefore, these were not attributed to potential changes in hydrodynamics caused by the operating turbine.[198] Additional findings from O'Carroll *et al*., (2017) show that if epifaunal communities at a single tidal energy device are negatively impacted, these effects are likely to be highly localised, within 20 m of the device.[199]

In the absence of any sizeable arrays of turbines, potential effects of array-scale wave and tidal energy projects on physical processes, hydrodynamics and seabed topography are limited to numerical simulations.[200] Speculations on cumulative effects of multiple arrays of tidal turbines on flow speeds and sediment dynamics foresee potential effects at a distance of up to 10km.[201] Findings from a recent hydrodynamic modelling study linking changes in natural velocity gradient in the Strangford Narrows (Northern Ireland) to variations in distribution of macro-benthic communities show that physical disturbances of sedimentary seabed resulting from the operation of multiple tidal energy turbines, would be unlikely to have a significant effect on benthic communities in high

195 Keenan G., Sparling C., Williams H., Fortune F., (2011) SeaGen Environmental Monitoring Programme: Final Report. Report by Royal Haskoning. 81pp. <https://tethys.pnnl.gov/publications/seagen-environmental-monitoring-programme-final-report> (accessed 10 December 2017), at 56-59
196 O 'Carroll J.P.J., and others, (2017b) 'Tidal Energy: The benthic effects of an operational tidal stream turbine', Marine Environmental Research, 129, 277
197 Ibid, 287
198 Ibid, 286
199 O'Carroll, Kennedy and Savidge (2017a), (n187), at 389, 397
200 Copping and others, (n182), 98-103
201 Miller R.G., and others, (2013) 'Marine renewable energy development: assessing the Benthic Footprint at multiple scale', Frontiers in ecology, 11(8), 433

tidal flow environments.[202] Additional modelling efforts further suggest that the deployment of small arrays of wave energy devices (up to 10 devices) would have minimal near-field effects on the physical environment and minimal far-field effects on sediment transport.[203] These findings are limited to modelling studies and, without any field measurement to validate these results, should be interpreted carefully. As the number of devices increase, incremental effects on the physical environment are predicted. Haverson *et al.*, (2018) indicated that the proposed array of 9 tidal energy converters at St David's Head (Wales) could act as a barrier to sediment transport, with potential adverse consequences for the benthic ecology of the region.[204]

4.3. Seabirds

Wave and tidal energy devices create particular collision risks for seabirds foraging in high energy environments due to the presence of submerged or semi-submerged device components.[205] Unlike OWFs, the effects of wave and tidal energy devices are not only species-specific but also technology specific.[206] Assessment of collision risks are currently derived from modelling studies based on the known abundance and distribution of seabird populations and the ecology of each species (more particularly their foraging ecology).[207] Species that represent higher collision risks are those diving in tidal races or areas of high velocity and at depths where the turbine blades are moving underwater. Species at greater risk may include European shag (*Phalacrocorax aristotelis*), great cormorant (*Phalacrocorax carbo*), common guillemot (*Uria aalge*),

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[202] Kregting L., and others, (2016) 'Do Changes in Current Flow as a Result of Arrays of Tidal Turbines Have an Effect on Benthic Communities?', PLoS ONE. 11(8), 1
[203] Baring-Gould and others, (n186), 24
[204] Haverson D., and others, (2018) 'Modelling the hydrodynamic and morphological impacts of a tidal stream development in Ramsay Sound', Renewable Energy, 126, 876
[205] Roche and others, (n188), 1333
[206] Langton R., and others, (2011) 'Seabird Conservation and Tidal Stream and Wave Power Generation: Information Needs for Predicting and Managing Potential Impacts', Marine Policy, 35(5), 623
[207] Furness and others, (n183), 1466

razorbill (*Alca torda*), black guillemot (*Cepphus grille*), Atlantic puffin (*Fratercula arctica*), red-throated diver (*Gavia stellata*), and northern gannet (*Morus bassanus*).[208] Wave and tidal energy devices may attract or deter foraging seabirds. For example, the attracting-effect has been shown at SeaGen where great cormorants significantly increased and moved from surrounding areas towards the turbine.[209] These results have been attributed to the artificial reef or fish aggregation effect of the turbine, enhancing fish abundance and foraging opportunities.[210] On the other hand, preliminary results of a statistical survey data analysis conducted at the EMEC test sites (Fall of Warness) indicate a change in density of auk species (i.e. black guillemot, common guillemot, Atlantic puffin, razorbill), cormorants and European shags, ducks and geese during the installations of test berths and devices.[211] Birds generally recovered when devices became operational. Reduction in seabird density at EMEC test sites was attributed to vessel movements during installation activities rather than to the presence of infrastructures/ devices. Collision risks with seabirds are therefore dependent on species and site-specific foraging strategies, their underwater manoeuvrability, diving patterns and spatial/seasonal variation in habitat use.[212]

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[208] Copping and others, (n182), 64

[209] Savidge G., and others, (2014) ‘Strangford Lough and the SeaGen Tidal Turbine’ in Shields M.A., Payne A.I.L., (eds) Marine *Renewable Energy Technology and Environmental Interactions* (Springer, Dordrecht, 2014), 159, 162

[210] Ibid.

[211] Long C., (2017) Analysis of the possible displacement of bird and marine mammal species related to the installation and operation of marine energy conversion systems. Scottish Natural Heritage Commissioned Report No. 947. <https://www.nature.scot/snh-commissioned-report-947-analysis-possible-displacement-bird-and-marine-mammal-species-related> (last accessed 10 April 2016), at 267-269

[212] Scott B.E., and others, (2014) ‘Seabirds and Marine Renewables: Are We Asking the Right Questions?’. In Shields M.A., Payne A.I.L., *Marine Renewable Energy Technology and Environmental Interactions* (Springer, Netherlands, Dordrecht, 2014), 81

4.4. Marine mammals and fish species

Unlike OWFs, the turbine blades and rotors of wave and tidal energy devices are underwater and may come with increased risks of physical injuries to marine mammals and demersal fish species from collision. The presence of ocean energy devices is thought to pose particular risks for animals in terms of colliding with rotating blades, underwater mooring lines or foundations of devices.[213]

There is growing evidence showing attraction of marine mammals, and more particularly seals, to energetic tidal channels for feeding and travelling.[214] The placement of a single operating turbine or array of turbines may create particular collision risks for seals that forage in fast-moving tidal current areas.[215] A limited number of field studies have measured animal movement around single operational devices. Monitoring results at SeaGen have shown that seals and harbour porpoises tend to avoid the turbine hence collision risks are reduced.[216] Field data collected through passive acoustic monitoring and telemetry at SeaGen provided indications of changes in the distribution of seals and harbour porpoises during construction and operation.[217] Data obtained from telemetry has nevertheless demonstrated that SeaGen did not result in a barrier effect as harbour seals were still transiting along each shoreline of the channel during operation.[218] No changes in seal abundance were observed but tagged seals exhibited avoidance behaviour by transiting further away from the centre of the

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[213] Copping and others, (n182), at 26-67

[214] Hastie G.D., and others, (2016) 'Dynamic habitat corridors for marine predators: Intensive use of a coastal channel by harbour seals is modulated by tidal currents', Behavioural Ecology and Sociobiology, 70, 2161; Joy R., and others, (2018) 'Empirical measures of harbor seal behavior of an operational turbine', Marine Pollution Bulletin, 136, 92

[215] Copping A., and others, (2017) 'Understanding the potential risk to marine mammals from collision with tidal turbines', International Journal of Marine Energy, 19, 110

[216] Keenan, Sparling, Williams and Fortune, (2011) SeaGen Environmental Monitoring Programme', (n195), at 23-24

[217] Savidge and others, (n209), 159-172

[218] Sparling C., Lonergan M., McConnell B., (2018) 'Harbour seals (*Phoca vitulina*) around an operational turbine in Strangford Narrows: No barrier effect but small changes in transit behavior', Acoustic Conservation, 28, 194, 202

Narrows.[219] Seals continued to transit on both sides of the channel at a distance of 250m from the SeaGen turbine during the operational phase.[220]

Harbour porpoises may have been temporarily displaced from the Narrows during the construction of SeaGen but there is evidence that porpoises generally returned to the Narrows after the installation period.[221] Displacement of porpoises was attributed to natural variability[222] and increased boat activity.[223] Avoidance behaviour was noticeable regardless of whether the turbine was operating or not. A very recent study using passive acoustic monitoring around the Delta Stream tidal energy turbine in Ramsay Sound (Wales) also shows that harbour porpoises and dolphin would have the capacity to detect the sounds generated by the turbine and to manoeuvre around it.[224] However, Malinka *et al*., stress that variation in site-specific behaviours and distribution patterns of animals means that the findings of this study are not transferrable to other tidal energy sites.[225]

Patterns of avoidance behaviours around wave energy converters, reported as a reduction of animal density, were observed by the EMEC Data Analysis Project around installed wave energy devices at EMEC test sites. Changes in marine mammal density (grey seals and harbour seals) were reported to occur during the installation of device-related infrastructures (test berths, anchoring and moorings systems) with a return to baseline conditions during installation and operation of devices.[226]

[219] Keenan, Sparling, Williams and Fortune, (n195), at 23; Sparling, Lonergan and McConnell, (n218), at 202
[220] Ibid
[221] Savidge and others, (n209), 160
[222] Keenan, Sparling, Williams and Fortune, (n195), 33; Savidge and others, (n209), 159
[223] Ibid.
[224] Malinka C., and others, (2018) 'First in-situ passive acoustic monitoring for marine mammals during operation of a tidal turbine in Ramsay Sound, Wales', Marine Ecology Progress Series, 590, 247
[225] Ibid.
[226] Long, (n211), 99-119, 269

Entanglement with mooring lines of ocean energy devices also represents an additional hazard for marine megafauna. Benjamin *et al*., (2014) propose a qualitative risk assessment approach to assess relative risk on marine megafauna on the basis of their biological characteristics and mooring features.[227] The results show that ocean energy moorings are unlikely to pose major threats to large marine vertebrates due to their size and mass.[228] Some mooring systems present higher risks (e.g. catenary moorings) and some species, in particular Baleen whales, would be at greatest risk due to their size and foraging habits.[229]

Additionally, the installation and operation of wave and tidal energy devices may affect marine mammals and fish species if they result in increased noise disturbance, underwater vibration and electromagnetic fields. The range effects of anthropogenic noise from operational devices may include behavioural changes and physical injuries. These effects may involve hearing loss, auditory injuries, tissue damage, masking of communication, reduction of prey detection and behavioural responses to discomfort.[230] Noise generated by ocean energy devices will vary depending on the type of devices (e.g. oscillating water column, vertical or horizontal axis devices) and the stage of deployment (installation versus operation).[231] Whilst the installations of many tidal energy devices do not require pile-driving activities, Fox *et al*., (2018) argue that other techniques involving drilling of anchors and armouring of cables using concrete mats and rock-dumping are also potentially noisy activities.[232] When pile-driving activities

[227] Benjamin S., and others, (2014) 'Understanding the potential for marine megafauna entanglement risks from renewable marine energy developments. Scottish Natural Heritage Commissioned Report No. 791. <https://tethys.pnnl.gov/sites/default/files/publications/SNH-2014-Report791.pdf> (3 July 2017), at 87
[228] Ibid, 65
[229] Ibid.
[230] Hawkins, A. D., Pembroke, A. E., Popper, A. N., (2015) 'Information gaps in understanding the effects of noise on fishes and invertebrates', Reviews in Fish Biology and Fisheries, 25, 39
[231] Copping A., and others, (2014) 'An international assessment of the environmental effects of marine energy development', Ocean & Coastal Management, 99, 3
[232] Fox C.J., and others, (2018) 'Challenges and opportunities in monitoring the impacts of tidal-stream energy devices on marine vertebrates', Renewable and Sustainable Energy Reviews, 8, 11926

are required to install wave energy devices, these involve smaller-diameter piles than those used for monopiles. Piling operations at wave energy sites are therefore expected to produce less significant noise levels on marine mammals than piling of offshore wind turbines.[233] To date, underwater noise from single devices has been measured and it is suggested that sound levels generated during installation and operation of single wave and tidal devices are generally below the threshold of harassment of marine mammals.[234] No data collected to date suggests that noise generated by multiple operational devices will exceed the sound threshold necessary to cause auditory injuries or tissue damage in marine animals.[235] Some field studies similarly suggest that noise levels from construction and operation of wave and tidal energy devices are unlikely to cause changes in behavioural patterns of marine mammals.[236] Although temporary displacements of harbour porpoises were observed during the construction of SeaGen, no significant displacements of seals and harbour porpoises were detected during the operational phase, although marine mammals were seen to avoid the centre of the channel during turbine operation.[237] Given this paucity of conclusive empirical data, insights into the interactions of marine mammals with multiple units primarily result from modelling studies using information gained from single devices.

With regards to the interaction of fish with wave/tidal energy devices, monitoring efforts on fish density and distribution around the Cape Sharp Tidal energy device during the pre-deployment and post-deployment phase have shown that, despite high

[233] Copping A., and others, (2013). Environmental Effects of Marine Energy Development around the World: Annex IV Final Report. Report by Pacific Northwest National Laboratory (PNNL), 96pp. <https://tethys.pnnl.gov/publications/environmental-effects-marine-energy-development-around-world-annex-iv-final-report> (accessed 20 August 2017), at 50-53
[234] Baring-Gould and others, (n186), 10
[235] Copping and others, (n182), 82
[236] Tougaard J., (2015) 'Underwater Noise from a Wave Energy Converter is Unlikely to Affect Marine Mammals', PLoS ONE, 10(7), 1.
[237] Sparling, Lonergan and McConnell, (n218), at 1649-1650

seasonal variability, there is no significant effect of the turbine on fish densities.[238] The findings of this study are preliminary. Due to important differences in the vertical distribution of fish between the reference area and the lease area, no conclusions could be drawn regarding the potential effects of the turbine on fish distribution in the water column.[239] Additional studies indicate high avoidance rates and thus, reduced collision risks with horizontal-axis turbines during the day and when fish are gathered in schools.[240] More recent findings at Cobscook Bay tidal energy turbine show that a single tidal energy device presents minimal risks to pelagic fish in that fish begin to avoid the turbine from 140m when the turbine was spinning.[241] Uncertainty exists due to limited data available to determine the distance at which fish detect noise generated by devices or the noise levels that would trigger a change in fish behaviour. Viehman emphasises that the physical interaction of fish with a device will vary depending on fish size, species and life stages of fish present in the location.[242] Avoidance will also be determined by sensing systems of fish and their capacity to detect the devices. It is therefore still unclear how the monitoring results collected for single devices or small arrays of devices could be transferred to inform about the impacts of commercial arrays of wave and tidal energy devices. As the number of devices increase, the ecological risks to fish are likely to be incremental.

The effects of EMF from export cables around wave and tidal energy devices are expected to be similar to those associated with offshore wind farms. As stated above,

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[238] Fundy Ocean Research Centre for Energy (FORCE), (2017) Environmental Effects Monitoring Program – Quarterly Report: January 1st – March 31, 2017. Annex I, p.22. Available at < https://fundyforce.ca/wp-content/uploads/2012/05/Final-FORCE-2017-Q1-Monitoring-Report.pdf> (3rd March 2017)
[239] Ibid
[240] Viehman H.A., Zydlewski G.B., (2014) 'Fish interactions with a commercial-scale tidal energy device in the natural environment', Estuaries and Coasts, 38, 241
[241] Grippo M., and others, (2017). Behavioural responses of fish to a current –based hydrokinetic turbine under multiple operational conditions: Final Report. In: ORPC LLC. (2016). Cobscook Bay Tidal Energy Project Environmental Monitoring Report. Report by Ocean Renewable Power Company (ORPC). 272pp., at 249
[242] Viehman H., (2016) 'Hydro acoustic Analysis of the Effects of a Tidal Power Turbine on Fishes' (Doctoral thesis. The University of Maine, 2016), at 27

EMFs from export cables and inter-array cables are within the known detectable range of a number of taxa (i.e. elasmobranches, bony fish, crustaceans and cetaceans).[243] Sensitivity to EMF has been reported for a number of species of taxonomic groups (section 2.3). Empirical observations to date have not demonstrated any negative impact from EMF related to wave and tidal energy devices on sensitive species.[244] Apart from the European Commission-funded MaRVEN project,[245] the evidence base for EMF effects associated with wave, tidal and offshore wind energy turbines/cables are limited to laboratory experiments.[246] Very few *in situ* monitoring studies of the effects of EMF around OWFs and ocean energy devices have been carried out.[247] Behaviour responses may potentially attract or deter fish and invertebrates.[248] EMF may also affect navigation and the ability of animals to navigate, detect prey, meet their mates and avoid predators.[249] Behavioural responses including changes in navigation and orientation (e.g. temporary alteration of swimming direction) have been reported for some species (i.e. eels, sturgeon, sharks and salmonids).[250] Responses were however variable within the same species, which means that no extrapolation of these results is currently possible to predict the significance of effects from multiple cables with higher power around multiple devices.[251] Recent studies indicate that EMF emitted around single devices would be of low intensity, close to background levels and only

[243] Thomsen F., and others, (2015) 'MaRVEN – Environmental Impacts of Noise, Vibrations and Electromagnetic Emissions from Marine Renewable Energy'. Report by Danish Hydraulic Institute, pp. 80. Available at <https://tethys.pnnl.gov/publications/marven-environmental-impacts-noise-vibrations-and-electromagnetic-emissions-marine> (20 February 2017), at 13
[244] Gill A.B., and others, (2014) 'Marine Renewable Energy, Electromagnetic (EM) Fields and EM-Sensitive Species'. In Shields M., Payne A.I.L. (eds.), Marine *Renewable Energy Technology and Environmental Interactions* (Springer, Dordrecht, 2014), 70
[245] Thomsen and others, (n243), 80
[246] Copping and others, (n182), 113-123
[247] Hattam C., Hooper T., Papathanasopoulou E., (2015). 'Understanding the Impacts of Offshore Wind Farms on Well-Being', The Crown Estate, 77pp. <https://doc.uments.com/d-understanding-the-impacts-of-offshore-wind-farms-on-well-being.pdf> (accessed 11 November 2016), at 38
[248] See further for a review of the evidence base on EMF: Gill and others, (2014), (n244), 69-73
[249] Ibid.
[250] Gill A.B., Bartlett M., Thomsen F., (2012) 'Potential interactions between diadromous fishes of UK conservation importance and the electromagnetic fields and subsea noise from marine renewable energy developments', Journal of Fish Biology, 81, 664; Öhman M.C., and others, (n108), at 630-633
[251] Copping and others, (n182), 113

perceptible within a few metres of the source.[252] As a result, the State of the Science Report considers that the interaction between EMF and marine animals is of low risk for small scale wave and tidal arrays.[253] However, the level of risk will increase 'as the industry develops' with 'longer-term projects, increasing and prolonging the potential EMF exposure' to marine animals.[254]

5 - Conclusion

Knowledge of the ecological footprints of OWFs has been steadily increasing as a result of ongoing research within the scientific and industrial community. Important knowledge has been gained regarding the pathway of impacts on marine mammals, seabirds, fish and benthos. The main sources of pressures associated with OWF typically include direct physical injuries and mortality from collisions, hearing damage and behaviour disturbance due to pile-driving noise and changes in local biodiversity as a result of the introduction of hard substrates. The nature and magnitude of these impacts, however, vary significantly on the basis of several factors related to the physical characteristics of the receiving environment, the number and spatial arrangement of turbines, scale of development and local abundance and density of affected habitats and species.[255] Monitoring results from one development site are not necessarily transferable to other wind farms located in different physical environments.[256] Data collected at a particular location may also only reflect specific species' behavioural patterns and functional use of this specific location. All these

[252] Baring-Gould and others, (n186), 37
[253] Copping and others, (n182), 122
[254] Ibid, 18
[255] May R., and others, (2017) 'Future Research Directive to Reconcile Wind Turbine-Wildlife Interactions' in Köppel J., (ed.) *Wind Energy and Wildlife Interactions. Presentations from CWW2015 Conference* (Springer, 2017), 264
[256] MMO, (2014), (n8), 121

variables require a case by case evaluation of development proposals to determine the scope and intensity of pre- and post-deployment monitoring.[257]

Negative acoustic impacts connected to pile-driving operations appear to be the main source of concerns for marine mammals. Scientific literature has consistently stressed that the impacts of underwater noise on marine mammals (pinnipeds and cetaceans) and fish species are more severe during the construction phase. A large body of scientific evidence indicates that high pulse sounds from pile-driving may induce adverse physiological effects such as temporary threshold shift or hearing loss and trigger changes in behavioural patterns of marine animals.[258] On the other hand, operational OWFs could have both positive and minor negative impacts on marine animals. Data from environmental monitoring demonstrate that low-level noise and vibration emitted by operating turbines would be unlikely to lead to hearing injury to cetaceans or seals or trigger behavioural changes.[259] Indirect impacts are more complex and may range from a loss of functional habitats and increased energy expenditure prompted by displacement behaviour of mobile species to avoidance of development areas. Whilst the construction phase is of greatest concern for marine mammals, risks posed to seabirds are particularly high during the operational phase of OWFs.[260] The following adverse effects have been identified in the scientific literature: 1) barriers to movement and migratory patterns, 2) loss of feeding habitat and 3) mortalities from collision risks.[261] These impacts were however highly site-specific, species-specific, seasonally-specific and dependent on a number of external variables including the geographical location of the development with regards to nesting/breeding colonies.[262]

[257] Ibid.
[258] Russell and others, 'Avoidance of wind farms by harbour seals', (n34), 1642
[259] MMO, (2014), (n8), 21
[260] Bailey, Brookes and Thompson, (n22), 6
[261] Danish Offshore Wind, (n35), 95
[262] Kaldellis J., and others, (2016) 'Environmental and social footprint of offshore wind energy. Comparison with onshore counterpart', Renewable Energy, 92, 543, 549

Positive impacts on of fish and invertebrates have been attributed to potential enhancement of habitat complexities permitted by the artificial-reef effect of turbines foundations and scour protections. Negative impacts primarily stem from direct mortality as a result of pulsed noise during pile-driving activities and replacement of infaunal communities by epifauna during the construction and operational phases. Taxa sensitive to electromagnetic fields have been identified. Research assessing species-specific responses to EMF is underway. The first evidence of changes in hydrodynamics and sediments has been provided by Vanhellemont and Ruddick[263] through aerial surveys and satellite imagery. In-water turbid wake effects associated with offshore wind turbines is characterised by increased local sedimentation and far-field changes in sediments deposition. Despite this preliminary evidence, understanding the potential ecological effects of this phenomenon on seabed topography, benthic assemblages and wider ecosystems remain largely speculative.

With respect to ocean energy devices, early demonstration projects including SeaGen, the Maine Tidal Energy project and the Cape Sharp tidal energy project provide relevant data that contributes to understanding most ecological interactions associated with wave ad tidal energy technologies. Findings from monitoring at single devices to date indicate that there is no evidence of adverse interactions of marine animals with operating turbines. As discussed above, in the absence of sizeable arrays, most of the evidence base is currently derived from monitoring around single devices.[264] The nascent technologies, in particular wave energy, lack a common technological design, which means that it is not possible at this stage to predict their ecological effects with sufficient confidence. In the absence of an established common design, the impacts of wave and tidal energy devices will vary according to the technology deployed.

[263] Vanhellemont and Ruddick, (n146), 105
[264] Copping and others, (n182), at 16,31,39, 174; Copping and others, (n190), at 7

Monitoring efforts for OWFs and ocean energy projects are primarily focused on individual ecological receptors. Population-level impacts and cumulative ecosystem impacts are largely unknown. Significant scientific uncertainty needs to be addressed with respect to the population consequences of noise disturbance, electro-magnetic fields and barrier effects associated with multiple OWFs and arrays of ocean energy devices. Assessing the species population consequences of ORE developments is however absolutely critical to predict and quantify risks to the conservation status of protected features in N2000 sites. Chapter III will complement this study by identifying the main areas of scientific uncertainty that are currently hampering environmental assessments for offshore renewables. This examination will consider whether best scientific knowledge and methodologies are available to project developers to predict and measures the impacts of ORE deployments. This analysis will inform subsequent developments challenging the judicial interpretation of the assessment requirements under the Habitats Directive.

CHAPTER III

EXPLORING SCIENTIFIC UNCERTAINTY

DOES BEST SCIENTIFIC KNOWKEDGE EXIST IN THE OFFSHORE RENEWABLE ENERGY SECTOR?

1- Introduction

'Contemporary science cannot deliver certainty as at the end of the day, it throws up more questions than it solves. To some extent, the more that is learnt in science, the more the limits to knowledge are understood. In the end the only certainty is uncertainty'.[1]

De Sadeleer's statement captures the theme of this Chapter. Whilst the focus of Chapter II was a comprehensive review of the state of scientific knowledge of the ecological impacts associated with offshore wind, wave and tidal energy developments, Chapter III examines the nature of scientific uncertainty currently pervading environmental impact assessments for ORE deployments.[2] This evaluation aims to answer a very simple question: does best scientific knowledge exist regarding the ecological impacts of ORE technologies in the marine environment? It is essential that lawyers and regulatory decision-makers clearly understand the challenges associated with gaining scientific data and knowledge in the marine environment. Poor understanding of science often

[1] Nicolas De Sadeleer, 'The effect of uncertainty on the threshold levels to which the precautionary principle appears to be subject' in Applegate J., (eds.), *Environmental Risks* (vol. 2, Ashgate, Dartmouth, 2004), 17

[2] As discussed in Chapter I, 'offshore renewable energy' is used as a generic term to refer to all types of renewable energy technologies deployed in the marine environment. In Chapter II, the author will also intermittently use the terms 'marine renewable energy' to refer exclusively to wave and tidal energy projects.

leads, as the author will demonstrate in Chapter IV, to unrealistic expectations for certainty in licensing processes and adjudicative processes. Surprisingly, this topic has received scant attention in legal literature. This examination intervenes in the context of the jurisprudence of the EU judiciary under the assessment requirements of Habitats Directive. Applying the precautionary principle, the CJEU has consistently found that, in order to be lawfully conducted, an appropriate assessment (hereafter: AA) must identify, beforehand and in the light of the 'best scientific knowledge in the field', the likely significant effects of projects on N2000 sites.[3] Existing scientific knowledge of dynamic marine ecological system is often extremely limited and this necessarily requires the application of the precautionary principle. A full legal discussion on the particular interpretation of the precautionary principle by the Court will be the core topic of Chapter IV. This Chapter intends to provide the scientific background that is necessary to determine whether 'best scientific knowledge' exists to predict and measure the impacts of ORE projects on the receiving marine environment.

Scientific uncertainty is a 'constant feature of environmental law'.[4] Notwithstanding this, this author will provide clear evidence suggesting that scientists and lawyers often approach scientific uncertainty in radically different ways. Whilst scientists tend to approach uncertainty 'as an opportunity to do research', lawyers perceive uncertainty 'as a barrier to enforceability and action'.[5] There is, therefore, a need to establish a common understanding. It is precisely the need to tackle uncertainty in the natural world that has fostered the raise of precaution in environmental law. 'Understanding scientific uncertainty is [therefore] crucial to the operation of the precautionary

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[3] Case C-127/02 *Waddenzee* [2004] ECR I-07405, para.54; Case C-304/05 *Commission v Italy* [2007] ECR I-7519, para. 69; Case C-404/09 *Commission v Spain* [2011] ECR I-11853, para. 99

[4] Elizabeth Fisher, Bettina Lange, Eloise Scotford, (eds). *Environmental Law: Test, Cases, and Materials* (Oxford University Press, 2013), 45

[5] Olivia O. Green and others, 'Barriers and bridges to the integration of socio-ecological resilience and law' (2015) 13 (6) Frontiers in Ecology and the Environment, 332, 332

principle'.[6] Schomberg notes in this respect that in order to properly apply the precautionary principle, 'a clarification is needed as to what is precisely understood by scientific uncertainty and what types of uncertainties are relevant for the invocation of the principle'.[7] It may be misleading to address the application of the precautionary principle to the ORE sector without first discussing the notion of 'uncertainty'.

Scientific uncertainty 'is nothing special'.[8] Even more so, 'uncertainty is a fact of life'.[9] Scientific uncertainty is 'inherent to [all] ecological risks'.[10] It results from the assumption that 'scientific predictability comes up against staggering limits in the field of the environment'.[11] As far as the natural world is concerned, 'there is a strong deficit in predictive capability'.[12] De Sadeleer observes that 'the distance in time and space between sources and damages, the cumulative and synergistic effects, the unpredictable reactions of [marine] ecosystems and the large scale of impacts compound the methodological difficulties in assessing these risks'.[13] Scientific uncertainty has however a greater impact on decision-making in the marine environment. Marine ecosystems are subject to a wide range of chaotic fluctuations that are not adequately modelled nor even understood by the scientific community.[14] While the status of terrestrial plants and animals is relatively well documented, much less is known about

[6] Patrick Jiang, 'A Uniform Precautionary Principle Under EU Law' (2014) 2(2) PKU Transnational Law Review, 490, 506

[7] Rene Von Schomberg, 'The precautionary principle and its normative challenges' in Fisher E, Jones J, Von Schomberg R, (eds.), *Implementing the Precautionary Principle Perspectives and Prospects* (Edward Elgar, 2006), 28

[8] Maria Lee, (ed.) *EU Environmental Law, Governance and Decision-Making* (vol. 43., Modern Studies in European Law, 2014), 38

[9] Warren Walker and others, 'Defining uncertainty: A conceptual basis for uncertainty management in model-based decision support' (2003) 4 Integrated Assessment, 6

[10] Nicolas Sadeleer, 'The Precautionary Principle in EC Health and Environmental Law' (2006) 12(2) European Law Journal, 139, 144

[11] De Sadeleer, (n1), 17

[12] Nicolas De Sadeleer, *EU environmental law and internal market* (Oxford University Press, 2014), 71

[13] Ibid.

[14] Ibid.

non-terrestrial systems.[15] Impact assessments in the marine environment are commonly regarded as 'the most challenging of all'.[16]

From there, scientific uncertainty is not just 'a problem at the margins, but one that seriously limits the utility of the environmental impact assessments'.[17] 'Failure to acknowledge and treat uncertainty can lead to poor decisions' and hence to poor conservation outcomes.[18] It is therefore highly necessary to understand, identify and categorise the different sources of scientific uncertainty associated with ORE developments to better deal with them in regulatory licensing processes.[19] To address this issue, Chapter III qualitatively categorises the major sources of uncertainty in environmental assessment procedures[20] for offshore renewables. It does so by analysing judicial understanding of 'scientific uncertainty' in European Courts case law related to the precautionary principle (section 2). The legal substance of the precautionary principle and its concrete application to ORE permitting will be further discussed in Chapter IV. Section 2 below will only refer to the precautionary principle for the purposive of defining the notion of scientific uncertainty. Section 3 reviews the typologies of scientific uncertainty in the scientific discourse in order to demonstrate why particular ecological risks associated with ORE developments are inherently uncertain. This investigation involves engaging with the environmental assessment reports of seven offshore wind farms (hereafter OWF). The author accessed the Natura

[15] Rosie Cooney, 'A long and winding road? Precaution from principle to practice in biodiversity conservation' in Fisher E., Jones J., Von Schomberg R. (eds.), *Implementing the Precautionary Principle Perspectives and Prospects* (Edward Elgar, 2006), 224

[16] Adam Smith, 'Impact Assessment in the marine environment – the most challenging of all' (IAIA08 Conference proceedings, 28th Annual Conference of the International Association for Impact Assessment, Perth, 4-10 May 2008), 1

[17] Fisher, Lange and Scotford, (n4), 851

[18] Helen M. Regan, and others, 'Robust decision-making under severe uncertainty for conservation management' (2005) 15(4) Ecological Applications, 1471; Milner-Gulland E.J., Shea K., 'Embracing uncertainty in applied ecology' (2017) 54 Journal of Applied Ecology, 2063

[19] Elizabeth A. Masden, and others, 'Renewable energy developments in an uncertain world: The case of offshore wind and birds in the UK' (2015) 51 Marine Policy, 169

[20] The term 'environmental assessments' is used as a generic for term the legally prescribed project-led environmental assessment processes under the Environmental Impact Assessment Directive and the Habitats Directive.

Impact Statements (NIS) and Environmental Statements (ES) for the most recent or largest OWF deployed in Europe including Horn Sea I and II, Inch Cape OWF, Neart Na Gaoithe OWF, Thanet OWF, London Array and Triton Knoll OWFs (United-Kingdom). The preliminary environmental report for Horn Sea Project III was also considered. This strategic choice is justified by the fact that the NISs and EISs elaborated for these developments were the most informative reports with respect to the nature and extent of monitoring difficulties and uncertainties encountered by ORE developers. In these reports, the main sources of uncertainty were also qualitatively described for the main sensitive receptors namely, fish and benthic ecology, marine mammals, physical environments and sea birds. The same process has been repeated for ocean renewable energy demonstration projects. The author extensively relied on the findings of the Annex IV State of the Science Report,[21] which as explained in Chapter II, is the most consolidated scientific contribution reviewing the ecological footprints of wave and tidal energy technologies.

Additionally, special attention is paid to the technical limitations of contemporary monitoring methodologies to consider whether or not best scientific knowledge can be reasonably expected from developers to inform an AA under the Habitats Directive. With a focus on offshore renewable energy, but without attempting to provide a comprehensive review of monitoring techniques, the purpose of this review is to reveal the strengths and weaknesses of the most commonly utilised monitoring techniques in the sector. An exhaustive review evaluating all monitoring systems could be the topic of an entire book. This study provides an overview of monitoring methods for site characterisation and post-consent monitoring. On the basis of these findings, Chapter

[21] Andrea Copping and others, (2016). Annex IV 2016 State of Science Report: Environmental Effects of Marine Renewable Energy Development Around the World. 224pp. <https://tethys.pnnl.gov/publications/state-of-the-science-2016> (accessed 19 February 2017)

IV will then constructively critique the evidentiary standard prescribed by the CJEU case law under the AA process of Article 6(3) of the Habitats Directive.

2- Defining scientific uncertainty in environmental impact assessments

Uncertainty is 'a non-intuitive term' that can be interpreted differently depending on the context where it is applied.[22] A large range of definitions has been advanced in legal and scientific literature. In general terms, uncertainty is a situation of incomplete information about a particular event and its characteristics.[23] Walker *et al.*, proposes a general definition of uncertainty as being 'any departure from the unachievable ideal of complete determinism'.[24] Butti further refers to uncertainty as a 'state of having a doubt, not being confident about the reliability, accuracy and relevance of the information'.[25] Scientific uncertainty 'does not pertain simply to a data gap but to a whole series of methodological, epistemological and ontological problems in scientific practice which means that science cannot provide the total truth'.[26] De Sadeleer argues that a large taxonomy of uncertainty exists ranging from lack of full evidence, lack of understanding of causal mechanisms, incorrect assumptions, inconclusiveness, indeterminacy and ambiguity of data all the way to complete ignorance,[27] which is the most extreme form of uncertainty.[28]

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[22] Ascough II J.C., and others, 'Future research challenges for incorporation of uncertainty in environmental and ecological decision-making' (2008) 219 Ecological Modelling, 383, 397

[23] Ibsen Cardenas, Johannes Halman, 'Coping with uncertainty in environmental impact assessments: Open techniques' (2016) 60 Environmental Impact Assessment Review, 24

[24] Walker and others, (n9), 8

[25] Luciano Butti, (ed.) *The precautionary principle in environmental law: neither arbitrary nor capricious if interpreted with equilibrium* (Giuffre Editore, 2007), 1-2

[26] Elizabeth Fisher, 'Is the Precautionary Principle Justiciable?' (2001) 13(3) Journal of Environmental Law, 315, 317

[27] De Sadeleer, (2014), (n12), 71

[28] Silvio O. Funtowicz, Jerome R. Ravetz, *Uncertainty and Quality in Science for Policy* (Kluwer, Dordrecht, 1990), 87

2.1. Scientific uncertainty in EU Courts

Scientific uncertainty in EU environmental law is commonly defined by reference to the precautionary principle. Scientific uncertainty is described as 'the linchpin around which the principle is organised'.[29] It is precisely the existence of scientific uncertainty as to the existence and severity of a potential harm that triggers the application of the precautionary principle.[30] Since *National Farmers' Union,* it is settled case law that where there is uncertainty as to the existence or extent of risks, the Institutions may take protective measures without having to wait until the reality and seriousness of those risks become fully apparent.[31] Pursuant to the EC Communication on the precautionary principle, the principle is relevant in the event of a potential risk, even if this risk cannot be fully demonstrated or quantified or its effects determined because of the insufficiency or inclusive nature of the scientific data.[32] The EC further outlines that the scope of the principle covers circumstances 'where scientific evidence is insufficient, inconclusive or uncertain and there are indications through preliminary objective scientific evaluation that there are reasonable grounds for concern that the potentially dangerous effects on the environment, human, animal, plant health may be inconsistent with the chosen level of protection'.[33] This definition implies that the application of the precautionary principle is justified in the event of a potential risk where the results of a

[29] Nicolas De Sadeleer, (ed.), *Implementing the Precautionary Principle: Approaches from the Nordic Countries, EU and USA* (London, Earthscan, 2007), 4
[30] Elen R. Stokes, 'The EC Courts' Contribution in Refining the Parameters of Precaution' (2008) 11(4) Journal of Risk Research, 491, 492
[31] Case C-157/96 *National Farmers' Union and Others* [1998] ECR I-2211, para.63; Case C-236/01 *Monsanto Agricoltura Italia and Others* [2003] ECR I8105, para.111; Case C-157/14 *Société Neptune Distribution v. Ministre de l'Économie et des Finances* [2015] ECLI: EU: C :2015 :823, para.82
[32] European Commission, 'Communication on the precautionary principle' (Communication) COM (2000) 1 final, at 13
[33] Ibid, at 9

preliminary scientific evaluation 'do not yield conclusive results'[34] about the gravity or probability of occurrence of a risk in question because of the insufficiency of the data, their inconclusive or imprecise nature.[35] As such, the precautionary principle must be distinguished from the principle of prevention whose application is warranted where the nature and scale of an impact are known or at least, can be predicted.[36]

The Court of Justice and the Court of First Instance (hereafter CFI) of the CJEU have shed some light on the judicial understanding of scientific uncertainty. Janssen and Rosenstock observe that the EU Courts equate uncertainty with risk in the context of the precautionary principle.[37] In Waddenzee for example, uncertainty is attributed to the existence of a risk that cannot be excluded on the basis of objective information.[38] 'Scientific uncertainty' and 'risk' closely intermingle in the context of the precautionary principle.[39] It is indeed, the existence of scientific uncertainty that creates the risk. Renn elegantly writes in this respect that 'within the frame of precaution, risk is seen from the perspective of pervasive uncertainty, ambiguity and, in particular, ignorance'.[40] The essential distinction between 'risk' and 'uncertainty' lies in the fact that the former is, in some cases, 'a quantity susceptible of measurement' while the later, 'uncertainty', refers to cases of a 'non-quantitative type'.[41] In the *Pfizer* case, the CFI found that a 'risk' constitutes a 'function of the probability' that the interest safeguarded will be adversely affected as a result of exposure to the hazard.[42] In this respect, the purpose of a risk

[34] European Commission, 'Study on the precautionary principle in EU environmental policies' (final report, November 2017), pp 114. <https://publications.europa.eu/en/publication-detail/-/publication/18091262-f4f2-11e7-be11-01aa75ed71a1/language-en> (accessed 13 April 2017), at 46
[35] European Commission, (n32), at 13-14
[36] Fisher, (n26), 318; Stokes, (n30), 496
[37] Anne-May Janssen, Nele F. Rosenstock, 'Handling Uncertain Risks: An Inconsistent Application of Standards? The Precautionary Principle in Court Revisited' (2016) 7(1) European Journal of Risk Regulation, 144, 151
[38] Case C-127/02 *Waddenzee* [2004] ECR I-07405, paras. 44, 45
[39] Anne-May Van Asselt, Ellen Vos, 'The Precautionary Principle and the Uncertainty Paradox' (2006) 9(4) Journal of Risk Research, 313, 315
[40] Ortwin Renn, 'Precaution and analysis: two sides of the same coin?' (2007) 8 European Molecular Biology Report, 303
[41] Frank H. Knight, *Risk, Uncertainty and Profit* (New York, 1921), at 19-20
[42] Case T-13/99 *Pfizer Animal Health SA* [2002] ECR II-03305, para.167

assessment 'is to assess the degree of probability [of an undertaking] of having an adverse effect and the seriousness of such adverse effect'.[43] Such a probability that an adverse effect will materialise is informed by the quality of scientific evidence supporting the evaluation of the risk. As such, 'risk' or 'measurable uncertainty' should be understood as 'a 'mathematically calculable' value[44] reflecting the likelihood of exposure to a particular event (probability of harm) and the gravity of the expected consequences (severity of harm) should this event materialise.[45] 'Uncertainty' seems to defy all mathematical quantification and denotes the impossibility of making exact predictions.[46] It arises from the insufficiency of the scientific basis, 'whether empirical or theoretical', to characterise a hazard in terms of probabilities and causal relationships.[47] Acknowledging this dichotomy, De Sadeleer, Janssen and Van Asselt contend that the application of the precautionary principle is related to 'uncertain risk',[48] namely, to situations where despite serious reasons to believe that there may be danger, the scientific evidence is 'neither sufficient to substantiate that danger nor to refute suspicions of that danger arising'.[49] As such, the 'raison d'être' behind the precautionary principle is to address 'uncertain risks which are not fully calculable and controllable' because 'the probability of occurrence or the effect in terms of damage cannot be estimated, although there are suspicions of danger'.[50] If the risk may be 'uncertain', it is settled case law that the precautionary principle can only be invoked if the available evidence shows that the seriousness of the risk is real and not

[43] Ibid, para.148
[44] Jiang, (n6), 503
[45] Arie Trouwborst, '*Precautionary Rights and Duties of States* (Martinus Nijhoff Publishers, 2006), 87
[46] Stokes, (2008), (n30), at 494
[47] Trouwborst, (n45), at 87; De Sadeleer, (n12), 71
[48] De Sadeleer, (n1), at 30
[49] Anne-May Janssen and Marjolein Van Asselt, 'The Precautionary Principle in Court – An Analysis of Post-Pfizer Case Law' in Van Asselt M., Versluis E., Vos E., (eds.) *Balancing between trade and risk: Integrating legal and social science perspectives* (London, UK: Routledge, 2013), 197; De Sadeleer, (n1), 30
[50] Van Asselt and Vos, (n39), at 315-316

hypothetical.[51] The seriousness of the risk must be scientifically confirmed by means of a preliminary comprehensive assessment 'based on the most reliable scientific data'.[52] In this vein, judicial understanding of the degree of evidence or uncertainty triggering the application of precautionary actions has been inconsistent.[53] The CJEU subordinates the application of the precautionary principle to the existence of a risk[54] that cannot be determined with absolute certainty because of the insufficiency, inconclusiveness or imprecision of scientific evidence.[55] In a number of decisions the CJEU has consistently held that:

> 'Where it proves to be impossible to determine with certainty the existence and extent of the alleged risk because of the insufficiency, inconclusiveness or imprecision of the results of the study conducted, but the likelihood of real harm to human or animal health or to the environment persists should the risk materialise, the precautionary principle justifies the adoption of restrictive measures'.[56]

Similarly, in *Pfizer*,[57] the CFI, although in slightly different terms, also ruled that:

> 'In a situation in which the precautionary principle is applied, which by definition coincides with a situation in which there is scientific uncertainty, a risk assessment cannot be required to provide the Community institutions with conclusive scientific evidence of the reality of the risk and the seriousness of the potential adverse effects were that risk to become a reality'.[58] 'Unless the precautionary principle is to be rendered nugatory, the fact that it is impossible

[51] Cases T-13/99 *Pfizer Animal Health SA v. Council of the European Union* [2002] ECR II-03305, para. 143; Case T-392/02 *Solvay Pharmaceuticals BV v. European Council* [2003] ECR II-4555, para.129
[52] Case C-333/08 *Commission v. France* [2010] ECR I-01697, para.92; Case C-192/01 *Commission v. Denmark* [2003] ECR I-09693, para.51; Case C-236/01 *Monsanto Agricoltura Italia SpA and Others* [2003] ECR I-08105, paras.113-114
[53] Janssen and Van Asselt, (2013), Op. cit, (n49), p.198
[54] *National Farmers' Union and Others*, (n31), para.63
[55] Cases C-77/09 *Gowan Commércio Internacional e Serviços L* [2010] ECR I-13533, para.76
[56] Case C-343/09 *Afton Chemical v. Secretary of State for Transport* [2010] ECR I-07027, para.61; *Gowan*, (n55), para.76*; Commission v. France*, (n52), para.93
[57] *Pfizer Animal Health SA*, (n51)
[58] Ibid, para.142

> to carry out a full scientific risk assessment does not prevent the competent public authority from taking preventive measures'.[59]

In light of this cited case law, 'scientific uncertainty' would pertain to the quality of scientific evidence and the associated capability of a risk assessment to characterise a risk. Scientific uncertainty is established whenever, due to insufficient, inconclusive or imprecise scientific evidence, a risk assessment cannot characterise 'the frequentist probability'[60] (i.e. likelihood of occurrence) of a particular event and the expected gravity of harm should this event materialises. The impossibility to provide exact predictions makes the risk uncertain, and this in turn justifies precautionary actions where there is a high incertitude about the 'probabilities, outcomes or both, and a high vulnerability of the [interest] at risk'.[61]

Whilst the qualitative criteria of 'insufficiency', 'inconclusiveness' and 'imprecision' seem to appear with some degree of clarity in the CJEU case law, no indication has been given by the EU judiciary on how these qualitative criteria must be interpreted by competent institutions.[62] Stokes notes that the EU jurisprudence is characterised by significant discrepancies regarding the evidentiary thresholds triggering the application of the precautionary principle.[63] Citing Sandin, Stokes argues that the definitional deficit of the precautionary principle 'extends to determining the nature and level of evidence or "nature of suspicion" triggering the application of precautionary actions'.[64] Some American scholars went so far as to conclude that the precautionary principle 'is too vague to serve a regulatory standard' because it does not specify when it should be

[59] Ibid, para.160
[60] Terms used by Terje Aven, 'On Different Types of Uncertainty in the Context of the Precautionary Principle' (2011) 31(10) Risk Analysis, 1515, 1516
[61] Renn, (n40), 303
[62] De Sadeleer, (n12), 80
[63] Stokes, (n30), 496
[64] Per Sandin, 'A Paradox out of context: Harris and Holm on the precautionary principle' (2006) 15 Cambridge Quarterly Healthcare Ethics, 175 – quoted in: Stokes, (n30), 493

apply and how much caution should be taken.[65] Against this backdrop, Garnett and Parson found that the level of evidence or degree of uncertainty that has been required by Courts to apply the principle vary depending on the interest at stake.[66] These authors reviewed a number of cases indicating 'a trend toward requiring less evidence of harm' where there was a risk to human health.[67] This is exemplified, quite clearly, in a number of judgements, including in *Solvay Pharmaceuticals*,[68] *Gowan*,[69] *BSE* (Bovine spongiform encephalopathy)[70] and *Pfizer*[71] where the application of the precautionary principle was upheld even in the absence or very low levels of conclusive evidence corroborating the reality of the risk. The Court found that EU Institutions were entitled to take stringent precautionary actions in the form of withdrawals, restrictions of a substance and a ban on bovine products, even in the absence of quantitative evidence, where there was a 'proper scientific basis for a possible risk' of development of resistance to antibiotic in human,[72] or if there was a 'probable link' between the disease affecting animals and disease affecting humans.[73] In *Gowan*, the Court upheld the restriction on the use of fenarimol on the grounds that 'there were still certain concerns regarding the intrinsic toxic effects of fenarimol'[74] and that 'such concerns cannot be considered to be based on purely hypothetical considerations'.[75] In *Solvay Pharmaceuticals*, the Court found that the competent EU Institutions did not commit a manifest error of assessment when deciding upon the withdrawal of authorisation for the Nifursol substance on the grounds that there were 'reasonable doubts' as to the

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[65] Daniel Bodansky, 'Law: Scientific Uncertainty and the Precautionary Principle' (1991) 7 Environment: Science and Policy for Sustainable Development, 4, 5
[66] Kenisha Garnett and David D. Parsons, 'Multi-Case Review of the Application of the Precautionary Principle in European Union Law and Case Law' (2016) Risk Analysis, 502
[67] Ibid, 513
[68] Case T-392/02 *Solvay Pharmaceuticals BV. v. European Council* [2003] ECR II-4555
[69] *Gowan*, (n55)
[70] Case C-180/96 *United Kingdom of Great Britain and Northern Ireland v. Commission of the European Communities (BSE)* [1998] ECR I-2265
[71] Case T-13/99 *Pfizer Animal Health*, (n51)
[72] Ibid, para.393
[73] *BSE*, (n70), paras.61-62
[74] *Gowan*, (n55), para.77
[75] Ibid, para.78

safety of this substance for public health.[76] In this case, the Court argued that the precautionary principle is designed to prevent 'potential risks'.[77] With regard to environmental cases taken under the Habitats Directive, the CJEU has construed the precautionary principle in such a way the principle applies where it cannot be excluded, on the basis of 'objective information' and beyond all 'reasonable scientific doubt', that a development will not have an adverse effect on the integrity of N2000 sites.[78]

A 'thorough canvas' of evidentiary thresholds justifying the application of the precautionary principle goes beyond the scope of this study. Science serves the purpose of guiding decision-makers when deciding on 'when to act' to avert a particular risk.[79] The level of uncertainty that is necessary before precautionary actions can be applied is a factual examination of the problem at hand. As a result, any attempt to identify a general 'threshold test' for precaution has been regarded as 'highly artificial'.[80] Fisher stresses that the precautionary principle is a process that obliges decision makers to scrutinise the science presented to them.[81] The principle does not dictate any particular decision-making outcome.[82] Stokes even perceives in the practice of the Courts (CJEU and CFI), a fervent acknowledgement of uncertainty and a deliberate tactic to 'liberalise the threshold of precaution' (broadening the meaning of uncertainty) in order to extend its scope of application.[83] While the lack of a consistent judicial threshold for precaution may render the precautionary principle, or at least its application, more

[76] *Solvay Pharmaceuticals*, (n68), paras.129 and 146-147
[77] Ibid, para.129
[78] Case C-127/02 *Waddenzee* [2004] ECR I-07405, paras.57, 59, 61
[79] Joel Tickner, David Kriebel, 'The Role of Science and Precaution in Environmental and Public Health Policy' in Fisher E., Jones J., Schomberg R., (eds.) *Implementing the Precautionary Principle: Perspectives and Prospects* (Edward Elgar, 2006), 47
[80] Fisher, 'Is the Precautionary Principle Justiciable?', (n26), at 318
[81] Ibid, 319
[82] Ibid
[83] Elen R. Stokes, 'Liberalising the Threshold of Precaution – Cockle Fishing, the Habitats Directive, and Evidence of a New Understanding of "Scientific Uncertainty"' (2005) 7(3) Environmental Law Review, 206, 210

‘ambivalent and malleable’,[84] what is clear, is that discrepancies between evidentiary thresholds triggering its application have precluded the establishment of a clear judicial understanding of what ‘scientific uncertainty’ means in EU law.

A more plausible explanation for the absence of clarification as to what constitute ‘insufficient’, ‘inconclusive’ or ‘imprecise’ scientific evidence may be directly attributed to the standard of judicial review applied by the CJEU. In cases involving complex scientific risk assessments, the Court tend to circumscribe the scope of their review to verifying whether the exercise of powers by EU Institutions has not been vitiated by a manifest error of appraisal, a misuse of power or whether the legislature has manifestly exceeded the limits of its discretion.[85] Both the CFI and CJEU made it clear that, in the face of assessments involving highly complex scientific and technical facts, institutions have broad discretion in determining the evidential threshold to apply precaution and the nature and scope of precautionary measures.[86] From there, the CJEU has refrained from extending their review to test the adequacy and quality of the scientific evidence presented to them.

Notwithstanding the lack of clear judicial understanding for scientific uncertainty, De Sadeleer offers some insight regarding the meaning of the criteria of ‘insufficiency’, ‘inconclusiveness’ and ‘imprecision’ as elaborated by the CJEU. De Sadeleer argues that ‘insufficiency’ of scientific evidence ‘may occur when the various scientific disciplines involved in assessing the risk are not sufficiently developed to explain the cause-and-effect relationship; Inconclusiveness: the realities of science dictate that the scientist

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[84] Joanne Scott and Ellen Vos, ‘The Juridification of Uncertainty: Observations on the Ambivalence of the Precautionary Principle within the EU and the WTO’ in Joerges C., Dehouse R., (eds.) Good Governance in Europe’s Integrated Market (Oxford University Press, 2002), 253

[85] Joined Cases T-74/00, T-76/00, T-84/00, T-132/00; T-137/00, T-141/00 *Artedogan v. Commission* [2002] ECR II-4945, para. 201; Case C-343/09 *Afton Chemical*, (n56), para. 28; Case C-425/08 *Enviro Tech (Europe) v. Belgian State* [2009] ECR I-10035

[86] Case T-31/07 *Dupont de Nemours* [2013] ECLI : EU : T:2013:167, para 156; Case T-392/02 *Solvay Pharmaceuticals*, (n68), para 128; Case C-343/09 *Afton Chemical*, (n85), para.28; Case C-77/09 *Gowan*, (n55), para.55; Case C-180/96 *BSE*, (n70) para.97

will never be able to sort out the relative influences of each factors; there may be too many unpredictable variables to enable the identification of the relative influence of each factor. Imprecision could be caused by the fact that the data to analyse the risks are not available or are out-of-date, information gaps, measurement errors, contradictions, ambiguity'.[87]

Whilst the criterion of insufficiency would be established, for example, in the case of a lack of data, inconclusiveness and imprecision may occur where a lot of data or information is available but does not necessarily decrease or eliminate uncertainty about the nature, occurrence and severity of a risk.[88] Van Asselt and Vos outline that: 'many of the uncertainties that are relevant in the context of the precautionary principle cannot be reduced, let alone be exorcised'.[89] This is because 'knowledge and uncertainty are not [necessarily] communicating vessels: uncertainty can still prevail in situation where a lot of information is available'.[90] Ascough *et al.*, note that new knowledge 'may reveal that our understanding is more limited or that the processes are more complex than previously thought'.[91] This situation is better known as 'data-rich-information-poor',[92] a situation where despite large amount of data, monitoring results do not provide meaningful information. Section 5 below will show that this undesirable 'syndrome' is common to all monitoring programmes carried out around ORE deployments in the marine environment.

It is worth noting that scientific uncertainty may also encompass contrasting scientific opinions.[93] In *Pfizer*, the CIF had to rule on the validity of the Council Regulation 2821/98 banning the use of antibiotics in animal foodstuffs including the virginiamycin.

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[87] See further: De Sadeleer, 9n12), at 71-72; De Sadeleer, (n29), 28
[88] Walker and others, 'Defining uncertainty', (n9), 8
[89] Van Asselt and Vos, (n39), 316
[90] Ibid.
[91] Ascough and others, (n22), 387
[92] Originally cited by: Robert C. Ward, Jim Loftis, Graham McBride, 'The data-rich but information poor syndrome in water quality monitoring' (1986) 10 Environmental Management, 291
[93] Janssen and Van Asselt, 'The Precautionary Principle in Court', (n49), at 205-206

For the sake of clarity, this case was characterised by divergent scientific opinions opposing the Scientific Committee on Animal Nutrition (SCAN) and a number of national expert bodies on whether the use of virginiamycin as a growth promoter in animals' foodstuffs constituted a risk to public health by contributing to the development of antibiotic resistance in humans. Although the CFI made it clear that 'it is not for the Court to assess the merits of either of the scientific points argued before it',[94] it expressly referred to the existence of contrasting scientific views to uphold a precautionary ban.[95] Commenting on the *Pfizer* judgement, Forrester and Hanekamp conclude that a condition of scientific uncertainty would therefore, also be satisfied in the face of divergent scientific opinions, irrespective of the merits of the scientific arguments.[96] This is consistent with the EC communication on the precautionary principle which explicitly states that scientific uncertainty may also arise from a controversy on existing data.[97] Although this interpretation has never been clearly acknowledged by the Court of Justice, Janssen and Van Asselt stress that a similar construction of 'scientific uncertainty' has also been upheld by the CFI in the *Alpharma* cases.[98]

In a nutshell, while the degree of uncertainty triggering the application of the precautionary principle 'is still open to debate',[99] some substantive criteria have been developed in the EU jurisprudence. First of all, a distinction must be drawn between the notion of 'scientific uncertainty' *per se* and the degree of uncertainty triggering the application of the precautionary principle. The degree of uncertainty justifying the adoption of precautionary actions has been primarily informed on a case-by-case

[94] *Pfizer Animal Health SA*, (n42), para.393
[95] Ibid, para.394
[96] Forrester and Hanekamp, 'Precaution, Science and Jurisprudence: A Test Case' (2006) 9(4) Journal of Risk Research, 297, 307
[97] European Commission, 'Communication on the precautionary principle', Op. cit, p.14
[98] Case T-70/99 *Alpharma Inc. v. Council of the European Union* [2002] ECR II-3495, para.37; See further: Janssen and Van Asselt, (n39), at 205-206
[99] De Sadeleer, (2006), Op. cit, (n10), 155

consideration of the interest at stake by EU Courts. As the case law currently stands, a quantitative definition of scientific uncertainty in the context of the precautionary principle does not exist. However, this short discussion has highlighted that a consistent ‘qualitative’ approach to the definition of scientific uncertainty may have emerged from the CJEU case law. Even though the three judicial criteria of insufficiency, inconclusiveness and imprecision may raise more questions than they solve, one may reasonably conclude that ‘scientific uncertainty’ relates to the quality of scientific data gathered in the scientific evaluation of the risk. Scientific uncertainty arises from situations where due to ‘the insufficiency, inconclusiveness or imprecision’ of the results of a scientific evaluation,[100] or dissenting scientific opinions, it is not possible to characterise, with absolute certainty, the probability of occurrence, causal relationships and/or outcomes of an impact.

[100]*Afton Chemical*, (n85), para.61 ; *Gowan*, (n55), para.76 ; *Commission v. Denmark*, para.52 ; *Commission v France*, para. 93, *Dupont de Nemours*, (n86), para.142

2.2. Scientific uncertainty in the scientific discourse

A number of typologies for scientific uncertainty that may help understand the substance of the judicial criteria of 'insufficiency', 'inconclusiveness' and 'imprecision' have been developed in applied ecology.[101] As observed by Cooney, 'uncertainty surrounds virtually every aspect of actual and threatened loss of biodiversity'.[102] While some uncertainties are reducible through measurement and data collection, other forms of uncertainty are simply inherent to all open ended and holistic ecological systems and as such, can rarely be eschewed through further investigations. While the former is commonly referred to as 'systemic', 'knowledge'[103] or 'epistemic' uncertainty',[104] the later, in its less tractable form, is known as 'variability' or 'random' uncertainty.[105] 'Systemic' and 'variability' uncertainty are the two main sources of uncertainty that have been found to hamper accurate environmental assessments for ORE proposals.[106] These are conducive to two types of errors in scientific investigations which are designed to test a hypothesis. A Type I error is a 'mistake of concluding that a phenomenon [or impact] exists where in truth it does not occur'.[107] Conversely, a Type II error is a failure to detect something that actually occurs.[108]

Variability uncertainty, which Trouwborst also refers to as 'ontological uncertainty',[109] stems from the inherent variability and stochasticity[110] of marine ecosystems.

[101] Helen M. Regan, and others, 'A taxonomy and treatment of uncertainty for ecology and conservation biology' (2002) 12 (2) Ecological Applications, 618; Walker and others, (2003), Op. cit, (n9), 5
[102] Cooney (2006), 'A long and winding road?', (n15), 229
[103] Ascough and others, (n22), 387
[104] Walker, and others, (n9), 13
[105] Ascough and others, (n22), 389
[106] Masden and others, (n19), 170
[107] Daniel Kriebel and others, 'The Precautionary Principle in Environmental Science' (2001) 109(9) Environmental Health Perspectives, 873
[108] Ibid.
[109] Trouwborst, '*Precautionary Rights and Duties of States*, (n45), 74
[110] Stochasticity refers to the characteristic of 'random behaviour of systems that have chaotic dynamics'. Stochasticity makes predictions impossible. See further: John Harwood and Kevin Stokes, 'Coping with

Stochasticity constitutes an 'essential but unpredictable component of all dynamic ecosystems'.[111] While prediction is the central role of all scientific investigations, Planque reminds us that stochasticity explains why science may not be able to predict future state of marine ecosystems with 'reasonable levels of certainty'.[112] Marine ecosystems host a myriad of complex interactions between the biotic (living) and abiotic (non-living physical) environment. Interactions range from predation, mutualistic/competitive and tropic interactions, nutrient cycling, sediment transport and hydrological regimes.[113] Without drawing a clear distinction between terrestrial and marine systems, Opdam *et al*., explain that local species populations of N2000 sites are part of larger regional populations and consequently are subject to 'spatially complex dynamics, partly due to variation, partly to large scaled environmental variation'.[114] By way of example, the number of animals of a population may fluctuate as a result of external environmental factors (e.g. weather conditions, fishing interactions and food availability) influencing their mortality, reproduction, recruitment rates and hence, the entire population structure. These types of natural variation in species' occurrence, abundance or behaviour are not inherently random but they nevertheless make 'the true value of interest extraordinarily difficult to measure or predict'.[115]

On the other hand, inherent randomness occurs 'not because of our limited understanding of the driving forces but because the system is, in principle, irreducible to

uncertainty in ecological advice: lessons from fisheries' (2003) 18 (2) TRENDS in Ecology and Evolution, 617, 618

[111] Benjamin Planque, 'Projecting the future state of marine ecosystems, "la grande illusion"?' (2016) 73 (2) ICES Journal of Marine Science, 204

[112] Ibid.

[113] Cooney, (n15), 229

[114] Paul F.M. Opdam, Mirjam E.A Broekmeyer and Fred H. Kistenkas, 'Identifying uncertainties in judging the significance of human impacts on Natura 2000 sites' (2009) 12 Environmental Science and Policy, 912, 915

[115] Helen M. Regan and others, (n101), 620

any deterministic process'.[116] Complex non-linear dynamics in marine ecosystems imply that 'predictions of the future state of the system may be highly uncertain, even when the underlying deterministic processes are known exactly'.[117] However, this is rarely the case in ecology.[118] Hence, variability/random uncertainty is largely attributed to the inherent difficulties in identifying and quantifying by means of data collection, the influence of non-linear and stochastic biological, chemical and physical factors on marine habitats and species populations. Unlike systemic uncertainty, uncertainty related to natural variability cannot be solved by means of increased data collection. This makes impact predictions impossible or at least, highly inaccurate.

Systemic or epistemic uncertainty includes the 'non-random'[119] and reducible element of scientific uncertainty. Masden *et al*., stress that systemic uncertainty 'is function of human understanding and measurement of a situation or environment'.[120] Systemic uncertainty arises from the lack or imperfection of knowledge as a result of missing or limited empirical data, which is usually linked to a 'lack of investigation, sampling errors, measurement biases'.[121] Systemic is probably the easiest form of scientific uncertainty in the context of the precautionary principle in that it can be reduced by additional data collection and empirical effort.[122] Application of the precautionary principle in this context should prescribe 'provisional or temporary measure until scientific investigation progresses adequately to describe more fully the risk'.[123]

[116] Ibid.
[117] Planque, (n111), 205
[118] Ibid.
[119] Masden and others, (n19), 170
[120] Ibid.
[121] Cooney, (n15), 229
[122] Walker and others, (n9); Ascough and others, (n22), 387
[123] Cooney, (2006), Op. cit, (n15), 229; See also: European Commission, Communication on the precautionary principle, (n32), 19

The lack of data or sampling issues in data collection will influence the level of confidence that developers and regulators can place in model predictions. Issues in sampling procedures may relate to the frequency and size of samplings and the type of data recorded by scientists. Since predictive models are sensitive to data inputs, uncertainty surrounding these variables will have a significant effect on predicted collision risks.[124] From there, systemic uncertainty is said to involve both a 'process understanding', which mainly refers to lack of empirical data or understanding of the deterministic behaviour of the system, and a 'modelling' component (i.e. model uncertainty), which results from the structure of computer models used by scientists to make impact predictions.[125] Models are inevitably simplified representations of the properties and behaviour of the ecological system or phenomenon being studied.[126] Planque argues that 'low predictive performances in marine ecosystem models are usually attributed to the absence or the poor representation of important ecological processes in numerical formulations'.[127] As far back as 1973, Holling had already explained that model predictions are necessarily flawed due to the 'mosaic of spatial elements with distinct biological, physical and chemical characteristics that are linked to each other by mechanisms of biological and physical transport'.[128] These phenomena significantly limit our capacity to realistically predict and represent, in computer models, changes in the natural world. Overall, natural variation and stochasticity phenomena in marine ecosystems constitute what Planque refers to as 'statistical nuisance' in model projections.[129] Citing Harremoës and Madsen, Ascough stresses that 'there is an optimum combination of model complexity and number of parameters as a

124 Trinder M., (2017) Offshore wind farms and birds: incorporating uncertainty in collision risk models: a test of Masden (2015) (Natural England Commissioned Reports, Number 237. York), Available at < http://publications.naturalengland.org.uk/publication/6638769899307008> (18 March 2017), at 2
125 Ascough and others, (n22), 388
126 Ibid.
127 Planque, (n111), 204
128 Holling C.S., 'Resilience and Stability of ecological systems' (1973) 4 Annual Review of Ecology and Systematics, 1, 16
129 Planque, (n111), 205

function of the data available for calibration'.[130] A model with few parameters may for example, be too simplistic or too complex to realistically represent trends in a valued receptor. In this situation, inherent 'structure' model uncertainty will dominate the results. Conversely, 'increased model complexity with many parameters to be calibrated will similarly lead to increased model uncertainty where 'calibrated parameters do not contain sufficient information to allow calibration of all parameters with an adequate degree of certainty'.[131] For instance, model uncertainty associated with sea birds collision risk models usually results from the fact that model parameters are 'data hungry' where the amount of available of data is limited.[132] Another limitation arises from the use of fixed parameters to represent dynamic variables such as flight speed and direction. This 'simplification' in parameters leads to increased uncertainty in model predictions.

A detailed analysis of model uncertainty goes beyond the scope of this study. Yet, it should be borne in mind that any scientific model relies on estimates, assumptions, equations and mathematical expressions which do not represent real-world issue. Any ecosystem model informing an environmental assessment is 'inherently incomplete because it is unlikely to encompass the full range of possible factors and their interactions'.[133] Accumulated uncertainties in data outputs and model parameters lead to prediction errors, also referred to as discrepancy between the 'true value' to be represented and models' predictions.[134] Model uncertainty in environmental assessments

[130] Ascough and others, (n22), 388
[131] See further: Harremoës P., Madsen H., 'Fiction and reality in the modelling world—balance between simplicity and complexity, calibration and identifiability, verification and falsification' (1999) 39(9) Water Science and Technology, 1
[132] Elisabeth A. Masden and Aonghais Cook, 'Avian collision risk models for wind energy impact assessments' (2015) 56 Environmental Impact Assessment Review, 43, 48
[133] Cardenas and Halman, 'Coping with uncertainty', (n23), 8
[134] Walker and others, (n9), at 7,9

will therefore always exist insofar as computer models will always be constrained by either systemic or variability elements of uncertainty.

Acknowledgement of the inherent limits in scientific methodologies may have triggered the requirement to make use of the ‘best scientific knowledge’ in the field. This throws up the thorny question of whether some patterns of best scientific knowledge have emerged from the evidence base available to ORE developers. The following section turns to this question.

3- Nature of uncertainty in environmental assessments for offshore renewables: What don’t we know?

Environmental assessments for ORE developments are largely constrained, although to a different extent, by both systemic and random elements of scientific uncertainty. Whilst systemic uncertainty has been significantly reduced in the offshore wind energy sector due to increasing post-consent data collection at installed OWFs, it remains the main source of uncertainty for the wave and tidal energy. Offshore wind, wave and tidal energy developments are however equally exposed to random uncertainty when it comes to assessing the potential population-level impacts and cumulative ecosystem impacts. Scientific uncertainty in predicting the population implications of ORE developments and their wider-ecosystem impacts concern all marine taxa with respect to their interaction with all types of technologies. The next subsection offers an overview of the main limitations related to available data for environmental assessments of ORE developments.

3.1. Practical examples of scientific uncertainty in environmental assessments of offshore wind farms

Common areas of systemic and random uncertainty have been identified in a series of Environmental Impact Statements (EISs) elaborated for six recently consented OWFs in the United Kingdom: Hornsea One, Hornsea Two and Hornsea Three OWFs, London Array, Thanet OWFs (Extension), Inch Cape OWF, Neart Na Gaoithe, London Array and Triton Knoll OWFs.

Despite improved evidence of behavioural responses of marine mammals to pile-driving operations, systemic uncertainty remains regarding the thresholds at which noise disturbances during the construction and operation of OWFs will cause hearing injury or trigger changes in animal behaviour.[135] Dose-responses to anthropogenic noise are highly dependent on animal habituation, sensitivity and motivation at the time of exposure (e.g. feeding, resting and breeding).[136] Animal responses to acoustic disturbance are further influenced by a number of environmental factors including the effect of bathymetry, current and seabed substrate on noise-propagation. The influence of these factors on noise propagation and behavioural responses of marine mammals is still poorly understood.

Likewise, both systemic and random uncertainty regarding the extent to which auditory injuries and chronic disruption of animal behaviours will lead to a decline in species

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[135] Vattenfall Wind Power Ltd., (2017). Thanet Extension Offshore Wind Farm Preliminary Environmental Report (Vol2 Chapter 7 Marine Mammals). <https://corporate.vattenfall.co.uk/projects/wind-energy-projects/thanet-extension/documents/preliminary-environmental-information-report/> (accessed 5 April 2017), at 10-11; Mainstream Renewable Power, (2016). Neart Na Gaoithe Offshore Wind Farm Environmental Statement Chapter 13 Marine Mammals. <http://nngoffshorewind.com/downloads/offshore-environmental-statement/> (accessed 5 April 2017), at 12-13

[136] Helen Bailey and others, 'Assessing the environmental impacts of offshore wind: Lessons learned and recommendation for the future' (2014) 10 (8) Aquatic Biosystems, 1

populations have been reported as a key issue in all the EISs reviewed.[137] Harwood and King estimate that an adverse effect on the conservation status of protected species will occur if animals incur sustained or chronic disruption of behaviour affecting animal vital rates (i.e. probability to survive, grow, give birth and breed).[138] In some situations, local impacts on a limited number of animals may have important biological consequences on population stability if the conservation status of this species is unfavourable.[139] Assessing the significance of an impact on species conservation status requires collecting long-time series of data to account for relevant natural variation in distribution and density of species population.[140] From the EISs reviewed, technical difficulties encountered by developers pertain to the complexities of collecting data on marine species population. The absence of baseline representative data on density/distribution are regularly reported, with more or less clarity, as the main obstacle to the evaluation of potential impacts on marine mammal populations at the site-specific level.[141] Generally speaking, less is known about the distribution and population structure of marine species. Fine-scale representative data on marine species population is lacking for a number species of European Interest. Baseline data may be lacking or,

[137] Smart Wind, (2013), Horn Sea Offshore Wind Farm Project One - Environmental Statement, Vol. 2 – Offshore. Chapter 4 Marine Mammals, at 64-67, 92; Vattenfall Wind Power Ltd., (2017), Thanet Extension Offshore Wind Farm - Preliminary Environmental Report, Vol.2 Chapter 7 Marine Mammals, para.7.5.7, at 10; Inch Cape, (2013). Environmental Statement, Chapter. 14: Marine Mammals. Available at <http://www.inchcapewind.com/publications/environmental-statement/BiologicalEnvironment/Chapter15/Chapter15> (accessed 16 April 2017), p.30; London Array, London Array Offshore Wind Farm Phase 2 Report to Inform Appropriate Assessment (October 2012), at 59,63; Mainstream Renewable Power, (2016). Neart Na Gaoithe Offshore Wind Farm Environmental Statement Chapter 12 Ornithology. Available at < http://nngoffshorewind.com/downloads/offshore-environmental-statement/> (accessed 25 April 2017), at 26, 44

[138] John Harwood and others, 'Understanding the Population Consequences of Acoustic Disturbances for Marine Mammals' in Popper A.N., Hawkins A., (eds.) *The Effect of Noise on Aquatic Life II* (New York, Springer, 2015), 419

[139] Clive J. Fox and others, 'Challenges and opportunities in monitoring the impacts of tidal-stream energy devices on marine vertebrates' (2018) 81 Renewable and Sustainable Energy Reviews, 1926

[140] Bailey and others, (n136), 6

[141] Inch Cape, (2013). Environmental Statement, Chapter. 14: Marine Mammals. <http://www.inchcapewind.com/publications/environmental-statement/BiologicalEnvironment/Chapter14/Chapter14> (11 November 2018), at 22 ; Vattenfall Wind Power Ltd. (2017) Environmental Statement, Vol.2 Chapter 7 Marine Mammals Op. cit., at 10; Orsted Power Ltd (2018), Horn Sea Project Three Offshore Wind Farm. Environmental Statement, Volume 5, Annex 4.1. Marine Mammals Technical Report (May 2018, Report Number: A6.5.4.1), paras.4.2.5.9, 4.2.5.10, at 60

when available, these may not cover sufficient periods of time to detect important variations in marine organisms which are necessary to understand the potential effects of a project (see section 5 below). Fox and others point out that 'the spatial scale of impacts may be much larger than the spatial footprint of a development and be beyond the means of individual developers to monitor adequately'.[142] Survey data collected by developers are usually snapshots of population dynamics and therefore, only provide an indication of the number of animals predicted to be affected by a development (section 5.1 below).[143]

Population modelling tools, such as the Interim Population Consequence of Disturbance approach (iPCoD),[144] have been developed to handle uncertainty and stochasticity in population impact assessments. These approaches aim to inform regulatory consenting about the population implications of disturbances on marine mammals.[145] These modelling approaches require estimates of population size and distribution, which are rarely available for populations of marine animals. As an interim approach, iPCoD heavily relies on expert elicitations to address these data gaps and inform model parameters.[146] Expert elicitation is a technique that is widely used in science conservation 'where there is a lack of data but urgent need for conservation decisions'.[147] Since expert judgements cannot substitute for real observational data,[148] modelling predictions are systematically biased by elements of model uncertainty

[142] Fox and others, (n139), 1931
[143] Vattenfall Wind Power Ltd. (2017). Vol 2. Chapter 7 Marine Mammals, (n135), p.10; Fox and others, (n139), at 1931-1932
[144] Stephanie L. King and others, 'An interim framework for assessing the population consequences of disturbances' (2015) 6 Methods in Ecology and Evolution, 1150; John Harwood and Stephanie King, 'The Sensitivity of UK Marine Mammals Populations to Marine Renewables Developments – Revised Version' (Report number SMRUC-MSS-2017-005, 2017) <https://data.marine.gov.scot/node/931/revisions/5706/view> (accessed 8 May 2017)
[145] Sparling C., Thompson D., Booth C.G., (2017). Guide to Population Models used in Marine Mammal Impact Assessment. (JNCC Report No. 607. JNCC, Peterborough, 2017), at 1, 8
[146] Harwood and King, (n144), at 15
[147] Carl Donovan and others, 'Expert elicitation methods in quantifying the consequences of acoustic disturbance from offshore renewable energy developments' in Popper A.N., Hawkins A., (eds.) *The Effect of Noise on Aquatic Life II* (New York, Springer, 2015), 232
[148] Ibid, 236

related to data inputs. Another method, Potential Biological Removals (PBR), is also used to set thresholds of ‘acceptable’ mortality that a population can safely incur before being adversely affected.[149] This methodology is also biased by model uncertainty related to the use of population size estimates.

With regard to seabirds, knowledge of flight heights of seabird species has enabled the identification of those species at greatest risk of collision and displacement around OWFs.[150] Empirical evidence collected around OWFs has shown that sea birds exhibit a relatively high level of micro-avoidance with low collision risks.[151] However these finding also indicate that these results were highly species-specific.[152] Information on flight characteristics and estimates of avoidance behaviour are still lacking for a significant number of species that are regularly occurring in OWFs.[153] The EISs reviewed reveal significant systemic uncertainty regarding the extent to which seabirds are displaced from their habitats and whether such displacement will have consequences for their reproduction, breeding and population stability.[154] For example, the EIS for the Hornsea Two OWF states that existing data gaps result from the inherent difficulties to collect data, particularly in the offshore environment, which can be used to accurately estimate mortality, collision chance, and associated avoidance behaviour.[155] Poor knowledge of population density/distribution and the ecology of seabird species represent an important regulatory challenge in the assessment of connectivity with

[149] Sparling C.E., Thompson D., Booth C.G., (n143), 8
[150] Robert W. Furness, Helen M. Wade, Elisabeth A. Masden, ‘Assessing vulnerability of marine bird population to offshore wind farms’ (2013) 119 Journal of Environment Management, 56
[151] Volker Dierschke, Robert W. Furness, Stefan Garthe, ‘Seabirds and offshore wind farms in European waters: Avoidance and attraction’ (2016) 202 Biological conservation, 59
[152] Ibid.
[153] Rhys E. Green and others, ‘Lack of sound science in assessing wind farm impacts on seabirds’ (2016) Journal of Applied Ecology, 1635, 1636
[154] London Array, (2012). London Array Offshore Wind Farm Phase 2. Report to Inform Appropriate Assessment, at 59, 63; Smart Wind Ltd, (2015). Hornsea Offshore Wind Farm Project Two. Environmental Statement Vol. 2 – Offshore, Chapter 5 Ornithology (Report No UK06-050200-REP-0005), at 67; Inch Cape Offshore Ltd, (2013). Environmental Statement Chapter 15: Ornithology. <http://www.inchcapewind.com/publications/environmental-statement/introduction> (20 March 2017), at 31
[155] Smart Wind Ltd, (n154), paras.5.6.83, at 67

nearby SPAs. As with marine mammal assessments, access to representative data on seabirds density and distribution is necessary to estimate the extent to which mortalities from collision or displacement may put the conservation status of species population at risk.[156] The use of foraging ranges has been advocated as a suitable method for assessing potential connectivity between breeding seabird colonies and proposed development sites.[157] However, the success of this method is hindered by considerable data gaps on structure of sea bird population and habitat uses in the marine environment. As such, establishing the population consequences of displacement cannot be measured empirically due to the lack of evidence and knowledge of species ecology and flight behaviour in offshore areas.[158] The paucity of baseline information means that developers must still address considerable uncertainty in estimating collision risk and displacement effects on sea birds.

Existing methodologies for collecting data and predicting the acceptability of OWFs for seabird populations are regarded as inadequate.[159] Green *et al*., explain that the so-called 'Acceptable Biological Change' (ABC), the 'Decline Probability Difference' (DPD) and 'Potential Biological Removals' (PBR)– modeling tools, are commonly used to define the threshold of acceptable impacts on sea bird populations.[160] These methodologies are based on long-term projections of seabird demographic rates which, in light of present knowledge, are highly uncertain and untested. PBR-based thresholds are highly sensitive to assumptions made about density-dependence relationships which are rarely known for sea bird populations.[161] As a result, the magnitude of effects on

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156 Furness, Wade, Masden, (n150)
157 Scottish National Heritage, (2018). 'Interim Guidance on Apportioning Impacts from Marine Renewable Energy Developments to Breeding Seabirds in Spatial Protection Areas'. 12pp <https://www.nature.scot/interim-guidance-apportioning-impacts-marine-renewable-developments-breeding-seabird-populations > (accessed 15 April 2019), at 2
158 Green and others, (n153), 1637
159 Ibid, 1637
160 Ibid, 1638
161 Ibid.

demographic rates and hence, on seabird populations, cannot be accurately estimated due to insufficient or imprecise empirical measurements to inform model parameters.[162] Impact thresholds calculated from these modelling tools to define the acceptability of OWFs have been criticised for being arbitrary and not grounded in a solid empirical basis.[163] To address these gaps, EISs and NISs tend to incorporate very conservative assumptions about the potential magnitude of impacts.[164] These assumptions may be over-precautionary and hence unrealistic.

Most EISs identify Electromagnetic Field (EMF) effects as a major source of systemic uncertainty due to limited research undertaken in this field.[165] There is little or no evidence suggesting that marine mammals, fish and shellfish would be adversely affected by EMF from subsea cables.[166] Scientific literature confirms EMF sensitivity for invertebrates, elasmobranches, bony fish, crustaceans and cetaceans, but species-specific impacts of EMFs within these taxonomic groups are largely speculative.[167] Existing knowledge gaps in understanding dose-responses of animals to EMF make it impossible to determine whether there are any biologically relevant consequences at the population-level.[168] Unfortunately, the lack of data has led some environmental

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[162] Ibid, 1639
[163] Ibid.
[164] Inch Cape Offshore Ltd, (2013) Environmental Statement Chapter 15: Ornithology, Op. cit, (n154), at 31-32*;* Smart Wind, (2013), Horn Sea Offshore Wind Farm Project One - Environmental Statement, Vol. 2 – Offshore. Chapter 4 Marine Mammals, para; 4.6.85; Smart Wind Ltd., (2015). Horn Sea Offshore Wind Farm Project Two– Environmental Statement Vol. 2 - Chapter 4. Marine Mammals, paras.4.6.73/6.4.143, at 68 and 92
[165] Orsted Power Ltd., (2018) Horn Sea Project Three Offshore Wind Farm, Environmental Statement – Chapter 3 Fish and Shellfish (May 2018, Report Number: A.6.2.3), at 61; Inch Offshore Cape, (2013), Environmental Statement Chapter 13: Biological Environment: Natural Fish and Fish. <http://www.inchcapewind.com/publications/environmental-statement/introduction> (accessed 25 May 2017), at 27
[166] Andrew B. Gill and others, 'Marine Renewable Energy, Electromagnetic (EM) Fields and EM-Sensitive Species' in Shields M., Payne A.I.L. (eds.), Marine *Renewable Energy Technology and Environmental Interactions* (Springer, Dordrecht, 2014), at 69-73
[167] Bull A., Gill. A.B., (2015). The Effects of Electromagnetic Fields on Marine Animals Webinar. (Thetys Webinar, Annex IV Environmental Webinar Series). <https://tethys.pnnl.gov/events/effects-electromagnetic-fields-marine-animals-webinar> (accessed 18 August 2017)
[168] Andrew B. Gill, Bartlett, Frank Thomsen, 'Potential interactions between diadromous fishes of UK conservation importance and the electromagnetic fields and subsea noise from marine renewable energy developments' (2012) 81 Journal of Fish Biology, 664

statements to conclude that EMFs impacts were negligible.[169] Likewise, much uncertainty exists with respect to the effect of pile-driving noise on fish and shellfish and the spatial extent to which noise-induced mortalities or tissue injuries may occur.[170] The evidence base to date carries with it high uncertainty due to many information gaps on hearing thresholds of fish and shellfish species.[171] Empirical information on dose-responses of fish and marine invertebrates to anthropogenic noise is scarce and no scientifically verified sound exposure criteria have been developed for fish and invertebrates.[172] Hawkins *et al*., argue that predictions in environmental assessments are based on the assumptions that all fish have similar hearing thresholds where in reality there are individual differences in sound detection, including among fish of the same species.[173] In the absence of further empirical observation, it is impossible to assess the potential population impacts of OWFs on fish and shellfish populations. As observed by Hawkins, 'bridging the gap between observed effects on individual fish and impacts on populations is often beyond our current capabilities'; 'we are poorly equipped to do any more than use expert elicitation for predicting impacts'.[174] Evidence of colonisation around turbine foundations have led scientists to conclude that sounds generated by operating turbines would not have major adverse effects on fish and benthic

[169] Frank Thomsen and others, (2015). MaRVEN – Environmental Impacts of Noise, Vibrations and Electromagnetic Emissions from Marine Renewables. Report by Danish Hydraulic Institute, 80pp. <https://tethys.pnnl.gov/publications/marven-environmental-impacts-noise-vibrations-and-electromagnetic-emissions-marine> (accessed 10 June 2017), at 11, 41
[170] Mainstream Renewable Power, (2016). Neart Na Gaoithe Offshore Wind Farm Environmental Statement Chapter 15 Fish and Shellfish. <http://nngoffshorewind.com/downloads/offshore-environmental-statement/> (accessed 23 June 2017), at 30-31; Vattenfall Wind Power Ltd, (2017) Thanet Extension Offshore Wind Farm. Vol.2 Chapter 6 Fish and Shellfish (November 2017). <https://corporate.vattenfall.co.uk/projects/wind-energy-projects/thanet-extension/documents/preliminary-environmental-information-report/> (accessed 26 March 2017), at 36; Smart Wind Ltd. (2015). Horn Sea Offshore Wind Farm Project Two– Environmental Statement Vol. 2. Chapter 3 Fish and Shellfish Ecology (Report No. UK06-050200-REP-0003), para.3.6.125, at 75
[171] Anthony Hawkins, Ann Pembroke and Arthur Popper, 'Information gaps in understanding the effects of noise on fishes and invertebrates' (2015) 25 Reviews in Fish Biology and Fisheries, 39
[172] Anthony Hawkins and Arthur Popper, 'A sound approach to assessing the impact of underwater noise on marine fishes and invertebrates' (2016) ICES Journal of Marine Sciences, 635, 642
[173] Hawkins, Pembroke and Popper, (n171), at 31
[174] Hawkins and Popper, (n172), 645

organisms.[175] Despite these findings, Thomsen *et al*., argue that no study has yet demonstrated any behavioural changes during the operational phase of OWFs.[176] Hawkins and Popper further note that most EIAs submitted for OWFs are flawed insofar as they are based on inappropriate metrics to describe thresholds of acceptable noise levels: 'the metrics used to assess the effects of noise effects were based on sound pressures, despite many of the fish species concerned being sensitive to particle motion'.[177] Whilst hearing capabilities of marine mammals are based on sound pressures, fish species and invertebrates can sense the particle motion component of sound.[178] The importance and function of the particle motion component of sound for the ecology of fish species and invertebrates is largely unknown.[179] There is little or no data at all on the effects of particle motion and seabed vibrations on demersal fish and shellfish.[180]

Furthermore, the Enviromental Statements for Thanet Extension and Triton Knoll Two OWFs highlight systemic uncertainty concerning the effects of these developments on sediment concentration, seabed topography and benthic ecology.[181] As emphasised in section 2.4 of Chapter II, in-water turbid wakes are common phenomena generated by

[175] Lena Bergström, Frida Sundqvist, Ulf Bergström, 'Effects of offshore wind farms on temporal and spatial patterns in the demersal fish community' (2013) 485 Marine Ecology Progress Series, 199, 207
[176] Thomsen and others, (n169), at 37
[177] Hawkins and Popper, (n172), 646
[178] Sophie L. Nedelec and others, 'Particle motion: the missing link in underwater acoustic ecology' (2016) 7 Methods in Ecology and Evolution, 836
[179] Ibid, 836
[180] Vattenfall Wind Power Ltd, (2017) Thanet Extension Offshore Wind Farm. Vol.2 Chapter 6 Fish and Shellfish (November 2017). Available at <https://corporate.vattenfall.co.uk/projects/wind-energy-projects/thanet-extension/documents/preliminary-environmental-information-report/> (accessed 6 July 2017), at 36
[181] Vattenfall Wind Power Ltd. (2017). Thanet Extension Offshore Wind Farm. Preliminary Environmental Information Report Chapter 3: Marine Water and Sediment Quality, para.3.6.2, at 9; Triton Offshore Wind Farm Ltd. (2015). Environmental Statement. Vol. 2., Chapter 2 Marine Physical Environment (April 2015, Revision A). <https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN020019/EN020019-000265-6.2.2.6%20Marine%20Mammals.pdf> (accessed 5 July 2017), para.2.40, at 13

the actions of currents around the foundation of turbines.[182] Sediment plumes are re-suspended in the water column and redistributed by currents up to several kilometres beyond individual turbines. Even 26 years after the commissioning of the world's first OWF,[183] the impacts of such a phenomenon on downstream sedimentation and marine fauna are still unknown. In the absence of detailed information, environmental predictions have been based on worst-case impact scenarios in terms of the highest concentration of suspended sediment plumes, the maximum changes in bed level elevation and the greatest spatial extent of ecological changes.[184] Other reports elaborated for Hornsea Two and Hornsea Three OWFs also raise both systemic and random elements of uncertainty surrounding impacts of artificial reef effects for local biodiversity and the wider receiving ecosystem.[185] Where these effects have been described as potentially positive in Chapter II,[186] the placement of turbine foundations on the seabed may in turn facilitate the introduction of non-native species. The wider-ecosystem impacts that non-native species will create for local diversity cannot currently be determined. EISs document the existence of uncertainty as to whether local species may benefit or be adversely affected by the introduction of non-native species which are different from the baseline environment.[187] Non-indigenous species may for example, have adverse effects by increasing competition and predation on local

[182] Vanhellemont Q., Ruddick K., 'Turbid wakes associated with offshore wind turbines observed with Landsat 8' (2014) 145 Remote Sensing of Environment, 105

[183] Global Offshore Wind Farm Database, Vindeby. <http://www.4coffshore.com/windfarms/vindeby-denmark-dk06.html > (last accessed 5, March 2017)

[184] Vattenfall Wind Power Ltd., (2017). Thanet Extension Offshore Wind Farm. Preliminary Environmental Information Report Chapter 2: Marine Geology, Oceanography and Physical Processes ABPmer Ltd, November 2017, Revision A), para.2.6.2, at 16

[185] Smart Wind Ltd. (2015). Horn Sea Offshore Wind Farm Project Two– Environmental Statement Vol. 2. Chapter 3 Fish and Shellfish Ecology (Report No. UK06-050200-REP-0003), at 85, para.3.6.202; Orsted Power Ltd., (2018) Horn Sea Project Three Offshore Wind Farm, Environmental Statement – Chapter 3 Fish and Shellfish, at 59

[186] Bergström and others, (n175), 199

[187] Orsted Power Ltd., (2018), Op. cit, (n165), at 59, 94 and 73; Smart Wind Ltd., (2015), Horn Sea Offshore Wind Farm Project 2. Environmental Statement Chapter 2 Benthic Subtidal and Intertidal Ecology (Report No. UK06-050200-REP-0002), paras. 2.6.159, 2.7, at 86; Inch Cape Offshore Ltd, (2013). Environmental Statement. Chapter 12: Benthic Ecology. <http://www.inchcapewind.com/publications/environmental-statement/BiologicalEnvironment/Chapter12/Chapter12 > (accessed 10 July 2017), at 32

species.[188] Important unknowns also exist as to whether the artificial reef effect associated with offshore wind turbines are enhancing local biodiversity, or simply attracting benthic communities and fish from surrounding areas. Post-consent monitoring activities around OWF sites have not demonstrated any positive or negative effects. Lindeboom highlights that, since ecosystems are still developing at most existing OWF sites, changes in macro-benthos observed so far should be considered short term as they probably reflect the initial stages of ecological changes.[189] According to Lindeboom, 'some impacts may not have been detected yet, simply because they have not developed to the extent needed to be detectable'.[190]

3.2. Practical examples of scientific uncertainty in the ocean renewable energy sector

Given their early stage of development, all sources of systemic/random uncertainty identified for the offshore wind energy sector similarly apply, with a higher degree if intensity, to wave and tidal energy projects. Wave and tidal energy developers are primarily exposed to systemic/knowledge sources of uncertainty regarding the nature of interactions of these devices with relevant marine receptors. The evidence-base to date is limited to monitoring studies at single wave and tidal energy devices.[191] No sizeable arrays of wave or tidal energy devices have been deployed so far and this significantly limits opportunities to collect array deployment data to validate the findings of numerical models simulating the effects of multiple turbines.[192] Scaling up risks from

188 Olivia Langhamer, 'Artificial Reef Effects in relation to Offshore Renewable Energy Conversion' (2012)12 The Scientific World Journal, 1, 8
189 Helen J. Lindeboom and others, 'Offshore wind park monitoring programmes, lessons learned and recommendations for the future' (2015) 756 Hydrobiologia, 169, 172
190 Ibid.
191 Copping and others, (2016) 'Annex IV 2016 State of Science Report', (n21), at 11, 16 and 39
192 Andrea Copping and others, (2018). The State of Knowledge for Environmental Effects. Driving Consenting/ Permitting for the Marine Renewable Energy Industry. Report by Pacific Northwest National

single devices to array-scale projects is therefore largely impossible due to limited number of operational deployments.

Uncertainty surrounding the nature and magnitude of collision risks with marine animals is a major consenting concern that may curtail the development rate of the industry. Significant knowledge and data gaps remain regarding the interaction process of marine mammals, fish and seabirds with operating wave and tidal energy devices. Of particular concern is the population of protected species for which the loss of a single animal may jeopardize population stability.[193] With regard to marine mammals, no collision with devices has been observed made to date.[194] As discussed in Chapter II, evidence of local avoidance by marine mammals in the vicinity of the SeaGen tidal turbine suggests that collision risks may be reduced for marine mammals.[195] The precautionary shut-down mitigation action required under the marine licence for the SeaGen device meant that opportunity to confirm animal behaviour and interaction with the turbine was lost.[196] The final removal of the shut-down protocol was approved but never implemented before decommissioning.[197] Consequently, Savidge *et al*., assert that despite five years of operation no relevant knowledge was gained on how marine mammals actually interact with the structure and moving blades.[198] The extent to which marine mammals are likely to collide with individual devices has therefore not been clearly established. It is also unclear whether animal collisions would systematically

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Laboratory (PNNL). 25pp. Available at <https://www.ocean-energy-systems.org/news/oes-publishes-a-position-paper-the-state-of-knowledge-for-environmental-effects/> (accessed 16 June 2018), at 7

193 Ibid, 8

194 Copping and others, (n21), at 26

195 Carol Sparling, Mike Lonergan, Bernie McConnell, 'Harbour seals (Phoca vitulina) around an operational turbine in Strangford Narrows: No barrier effect but small changes in transit behaviour' (2018) Acoustic Conservation, 194

196 Graham Savidge and others, (2014), 'Strangford Lough and the SeaGen Tidal Turbine' in Mark A. Shields, Andrew I.L. Payne (eds.) *Marine Renewable Energy Technologies and Environmental Interactions* (Springer, 2014), 153

197 Frank Fortune, 'Adaptive Management – A tidal stream example from the UK' (ETIPOCEAN Webinar, 'Adaptive Management – Don't make the same mistake twice!' (13 December 2017). <https://www.etipocean.eu/events/webinar-5/> (last accessed 1 March 2018)

198 Savidge and others, (n196), 153

lead to injury or death.[199] The absence of clear understanding on how animals behave around operating devices significantly complicates progress towards approvals of array-scale projects. The Annex IV State of the Science Report indicates that it is highly unlikely that risk will scale on a 'simple linear fashion' as the number of devices increase.[200] In the absence of further observation and in-situ measurements around full-scale arrays of devices, evaluation of collision/encounter interactions with marine animals are currently restricted to modelling simulations and laboratory experiments.[201] Evaluating the full effects of multiple devices on marine Natura 2000 sites and their qualifying species may not be possible until arrays deployment data from arrays is actually collected.[202]

In a similar vein, there is no empirical evidence on the physical interactions/collisions of seabirds with underwater devices.[203] Most environmental studies to date 'have focused on potential changes in habitat use and displacement effects on seabirds resulting from the presence and operation of devices rather than on collision risks'.[204] The paucity of empirical study addressing collision risks of diving seabirds primarily results from difficulties in monitoring seabirds in highly energetic underwater environments.[205] Assessment of collision risks are currently being derived from modelling studies based on the known abundance, distribution and ecology of each seabird species (e.g., foraging ranges, flight height and speed).[206] The effects of underwater noise associated with a commercial array of devices are also largely

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[199] Copping and others, (n21), at 44
[200] Ibid.
[201] Gordon D. Hastie and others, 'Harbour seals to avoid tidal turbine noise: Implications for collision risk' (2017) Journal of Applied Ecology, 684
[202] Copping and others, (n192), 7
[203] Ronan C. Roche and others, 'Research priorities for assessing potential impacts of emerging marine renewable energy technologies: Insights from developments in Wales (UK)' (2016) 99 Renewable Energy, 1327
[204] Copping and others, (n21), 63
[205] Ibid.
[206] Robert W. Furness and others, 'Assessing the sensitivity of seabird populations to adverse effects from tidal stream devices and wave energy devices (2012) 69 ICES Journal of Marine Science, 1466

unknown. Here again, knowledge has been limited to single devices. At this stage, underwater noise from single devices can be measured but there are no standards for measuring noise effects associated with arrays of several devices.[207] Likewise, sound measurements around existing wave and tidal energy devices tend to focus on sound pressure even though a number of marine species are known to be only sensitive to particle motion.[208] How the acoustic output of multiple turbines may affect marine animals is also unknown. [209] A key issue that needs to be addressed is whether noise from commercial-scale arrays will result in chronic behavioural changes and affect animal vital rates, thereby creating larger adverse population consequences. Uncertainty regarding the effect of underwater noise on marine mammals and fish will remain an important source of concern for regulators. In light of the existing evidence base, it is not possible to extrapolate or scale-up the findings from monitoring programmes to determine the impacts of multiple devices.

207 Baring-Gould E.I., and others, (2016), 'A Review of the Environmental Impacts for Marine and Hydrokinetic Projects to Inform Regulatory Permitting: Summary Findings from the 2015 Workshop on Marine and Hydrokinetic Technologies' (Report by H.T. Harvey & Associates, Kearns & West, and National Renewable Energy Laboratory, NREL) <https://tethys.pnnl.gov/publications/review-environmental-impacts-marine-and-hydrokinetic-projects-inform-regulatory> (Accessed 30 April 2017), 70pp., at 11

208 Ibid.

209 Copping and others, (n192), 7

4 - Cumulative and in-combination impacts

Cumulative impacts result from incremental changes and 'additive impacts caused by other past, present and reasonably foreseeable actions together with the project itself and synergistic impacts (in-combination) that arise from the reaction between impacts of a project on different aspects of the environment'.[210] Cumulative impacts can be both additive and synergistic.[211] The Guidelines of the British Standard Institutions stress that impacts may become additive where many minor effects on a single species, albeit non-significant individually, add up to create a significant overall impact on species population.[212] Synergistic impacts (in-combination) result from the interaction of multiple small impacts on a specific receptor, even if these impacts are not individually significant.[213] Assessments of cumulative impacts, whether synergistic or additive, represent a significant challenge for developers. Uncertainty surrounding cumulative impacts has caused delays of up to three years in the approvals for some Round 2 OWFs in the United-Kingdom.[214]

Assessment of cumulative and in-combination impacts is largely hampered by the lack of agreement on what 'cumulative impacts' mean and methodological flaws in conducting cumulative impact assessments (CIAs).[215] Ambiguity in the terminology of 'cumulative impact assessment' is well exemplified in the key legislative drivers for

[210] RenewableUK, (2013). Cumulative Impact Assessment Guidelines: Guiding Principles For Cumulative Impacts Assessment in Offshore Wind Farms (RenewableUK, June 2013), p.6; European Commission, 'Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions' (NE80328D1/3, May 1999). Available at <http://ec.europa.eu/environment/eia/eia-support.htm> (accessed 12 July 2017), at 7
[211] RenewableUK, (n210), at 6
[212] British Standards Institution, 'Environmental Impact Assessment for Offshore Renewable Energy Project – Guide' (March 2015). <http://shop.bsigroup.com/upload/271276/PD%206900.pdf> (20 August 2017), at 22
[213] Ibid.
[214] RenewableUK, (n210), at 4
[215] Edward A. Willsteed and others, 'Obligations and aspirations: A critical evaluation of offshore wind farm impact assessments' (2018) Renewable and Sustainable Energy Reviews, 2332, 2333

EIA.[216] Under the Habitats Directive, any ORE project that is likely to have a significant effect on a N2000 site shall consider the in-combination effects on the relevant site concerned.[217] Whilst the Habitats Directive refers to the 'in-combination' effects of a project on N2000 site, the revised EIA Directive provides that the characteristics of the project must be considered having regard to the 'cumulation of existing and/or approved projects'.[218] The SEA Directive, on the other hand, provides that an environmental assessment identifying the 'secondary, cumulative, synergistic […] positive and negative effects' shall be carried out for public plans likely to have significant environmental effects.[219]

Inconsistencies in terminology may have contributed to the lack of a coherent methodological approach to CIA.[220] As far back as 1999, guidelines were issued by the European Commission to support more coherent methods and approaches to CIA.[221] Methodologies to assess cumulative impacts of OWFs have also been developed by the scientific community.[222] However, the success of these methodologies is limited by considerable difficulties in identifying appropriate historical baselines as well as spatial and temporal scales over which cumulative impacts should be assessed.[223] CIA methodologies should extend beyond the scope of site-specific direct and indirect

[216] Adrian Judd, Thomas Backhaus and Freya Goodsir, 'An effective set of principles for practical implementation of marine cumulative effect assessment' (2015) 54 Environmental Science and Policy, 254, 256

[217] Directive 92/43/ECC of the Council of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (Habitats Directive) [1992] OJ L 206/7, Article 6(3)

[218] Directive 2014/52/amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment [2014] OJ L.124/1, Article 4(3) and Annex III (1) (b)

[219] Directive 2001/42/CE of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment (SEA Directive) [2001] O.J. L.197/30, Article 5(1), Annex I.

[220] Marine Management Organisation (MMO), (2013) 'Evaluation of the current state of knowledge on potential cumulative effects from offshore wind farms (OWF) to inform marine spatial planning and marine licensing', MMO Report No:1009, 71pp. Available at <https://webarchive.nationalarchives.gov.uk/20140305093347/http://www.marinemanagement.org.uk/evidence/1009.htm> (accessed 20 April 2017), at 10

[221] European Commission, 'Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions' (May 1999). <http://ec.europa.eu/environment/eia/eia-support.htm> (20 June 2016)

[222] Willsteed and others, (n215)

[223] Melissa M. Foley and others, 'The challenges and opportunities in cumulative effects assessment' (2017) 62 Environmental Impact Assessment Review, 122

impacts[224] to consider how incremental pressures arising from a single development together with the sum of past, present and future overlapping activities will affect trends in receptor conditions.

Project-based CIAs for ORE projects are challenging due to significant knowledge gaps surrounding the impacts of all other existing or planned activities on marine ecosystems. Random and systemic uncertainty associated with proximate developments will accumulate to make CIA even more complex. Knowledge gaps are also exacerbated by uncertainty over how these impacts overlap and propagate in time and space through the marine environment.[225] Willsteed evaluated CIA for nine large-scale OWFs and concluded that current project-led practices do not meet the information needs of regulatory decision-makers.[226] Cumulative impacts in the marine environment encompass changes brought about by multiple stressors and activities that interact and accumulate over broad temporal and spatial scales. Environmental pressures in the marine environment interact in a 'non-linear relationship' to generate 'a variety of outcomes, including synergistic and antagonistic effects'.[227] Hence, 'understanding the cumulative effects of a development requires, by definition, consideration of the sum total of effects on the environment to date and the incremental effects that a proposed development will have on that baseline'.[228] This seems to confirm the findings of Therival and Ross who state that CIA should 'help to link the difference scales of environmental assessment in that it focuses on how a given receptor is affected by the totality of plans, projects and activities, rather than on the effects of a particular plan or project'.[229] CIA methodologies must therefore establish a fixed baseline against which

[224] MMO, (2013), (n220), at 11
[225] Edward A. Willsteed and others, 'Assessing the cumulative effects of marine renewable energy developments: establishing common ground' (2017) 577 Science of the Total Environment, 19, 21
[226] Willsteed and others, (n215), at 2332, 2341
[227] Judd, Backhaus and Goodsir, (n216), 259
[228] Willsteed and others, (n215), 2341
[229] Ricky Therivel and Bill Ross, 'Cumulative effects assessment: Does scale matter?' (2007) 27 Environmental Impact Assessment Review, 365, 335

cumulative impacts can be predicted, taking into account the spatio-temporal mobility of valued receptors and the spatial and temporal accumulation of multiple stressors. Despite this, assessment practices have been reported to invariably endorse a single stressor approach, 'assessing how single stressors (e.g. noise disturbance, habitat loss) generated by a proposed development together with the same stressor arising from proximal developments impact a single valued receptor'.[230] CIA methodologies that are focused on a single stressor approach are regarded as particularly ill-suited insofar as the spatial and temporal boundaries of stressor effects, for example noise propagation, do not match the spatio-temporal characteristics of wide-ranging marine receptors.[231]

Further, the review of post-consent OWF monitoring indicates that discrepancies between methodologies, sampling techniques and data presentation prevent a 'synoptic approach' where monitoring information from different sites can be scientifically compared to evaluate cumulative pressures.[232] This shortcoming has been observed for all receptors including marine mammals,[233] fish and shellfish,[234] benthic habitats and benthic communities.[235] The lack a common methodological approach is further exacerbated by the fact that wider-ecosystem impacts of ORE developments are largely unknown. Developers currently face difficulties to confidently predict and mitigate potential direct and indirect ecological impacts of large-scale ORE developments on ecosystem dynamics. Shortcomings primarily stem from a significant lack of scientific understanding on the cause-effect relationships between ecosystem components.[236] Marine ecosystems are 'chaotic by the unpredictable and manifold mutualistic, trophic

[230] Willsteed and others, (n225),23
[231] Ibid.
[232] Marine Management Organisation (MMO), (2014). Review of post-consent offshore wind farm monitoring data associated with licence conditions. A report produced for the Marine Management Organisation, MMO Project No: 1031, 194pp. <https://www.gov.uk/government/publications/review-of-environmental-data-mmo-1031> (12 February 2017), at 96
[233] Ibid, at 125
[234] Ibid, at 92,97
[235] Ibid, at 82-83
[236] MMO, (2013), (n220), at 37

and competitive interactions between species and a large natural variability'.[237] The inherent complexity and connectivity between marine receptors suggest that project-based EIA are unlikely to resolve the 'conundrum of cumulative impact assessment'.[238] Species interact within communities and across multiple trophic levels.[239] Each ecological receptor may perform a myriad of ecological functions including habitat provisions and secondary production. Impacts on one functional receptor or key structural species may therefore indirectly affect the conservation status of an associated or dependent species and ultimately create non-anticipated wider-scale ecosystem impacts.[240] Such connectivity between marine species and their environment may lead to indirect impacts on valued receptors as a result of changes in prey availability and food-web dynamics.[241] Understanding the interactions between valued receptors and their food is critical to understand potential cumulative impacts. The majority of studies have concentrated on the enhancement of local biodiversity around turbine monopiles but the ecological functions of these new benthic systems in relation to other protected receptors such as marine mammals and sea birds has been identified as a clear knowledge gap.[242]

[237] Lindeboom and others, (n189), 172
[238] Judd, Backhaus and Goodsir, (n216), 254
[239] Roel May and others, (2017) 'Future Research Directive to Reconcile Wind Turbine-Wildlife Interactions' in Köppel J., (ed.) *Wind Energy and Wildlife Interactions. Presentations from CWW2015 Conference* (Springer, 2017), 271
[240] Lindeboom and others, (n189), 171
[241] Willsteed and others, (n225), 23
[242] Ibid, 37-38

5 - Monitoring limitations in the marine environment

5.1. Specificities of monitoring challenges in the marine environment

There are significant limits to what can be reasonably 'achieved through project-led monitoring programmes on a site-specific basis'.[243] Bennet *et al.*, explain that the relatively small scale of ORE developments makes monitoring works extremely challenging due to the existence of stochasticity and important natural variation influencing how animals and marine organisms use and respond to the marine environment.[244] Some impacts are simply not detectable by project developers at the scale of development sites. Difficulties associated with detecting an impact mainly stem from the degree of natural viability in behaviour, abundance, distribution of marine species and the difficulties in detecting animals underwater in poor visibility conditions.[245] Some species travel over thousands of kilometres and spend most of their time underwater. Marine mammals for example are extremely difficult to detect due to their large dispersal range, cryptic behaviour and intermittent echolocation signals. Similarly, populations of seabirds are subject to important temporal variation operating at scales wider than survey areas, making it difficult to understand cause-effect relationships and distinguish project-impacts from background natural variation.[246] Fox and others further point out that the conservation status of many marine species are influenced by a number of external stressors, natural variation and large-scale stochastic factors that are related to fisheries interactions, climate change,

243 MMO, (2014), (n232), at 168

244 Bennet F., Culloch R., Tait A., (2016) Guidance on effective Adaptive Management and post-consent monitoring strategies. Deliverable 5.2 & 5.4., RiCORE project, 45pp., <http://ricore-project.eu/wp-content/uploads/2016/07/RiCORE-D5-2D5-4-Adaptive-Management-and-Post-Consent-Monitoring-Strategies-Final.pdf > (last accessed 15 May 2018), at 42

245 Ilya Maclean and others, 'Resolving issues with environmental impact assessments of marine renewable energy installations' (2014) 75 Frontiers in Marine Sciences, 1, 3

246 MMO, (n232), at 168

food web dynamics and weather conditions.[247] The influence of these factors combined with the large mobility and dispersal ranges of marine species exacerbate the problem of 'Data-Rich but Information Poor'(DRIP) syndrome.[248] As briefly mentioned above, DRIP is an undesirable situation where, despite considerable monitoring efforts and collection of large amount of data, monitoring results do not provide useful information that can give greater confidence to decision-makers.[249] All types of ORE projects including OWFs commonly suffer from DRIP. Lessons learned from OWFs across the North Sea, indicate that basic monitoring around OWFs is not sufficient to 'disentangle specific cause-effect relationships, especially in systems with a high natural variability'.[250] Maclean and others have also shown that the design of visual seabird surveys for the Round 2 of OWF developments in the United-Kingdom lacked sufficient statistical power to detect consistent changes in sea bird populations due to important fluctuations in the numbers and distribution of birds at any given location.[251] 'Statistical power' refers to the capacity of a monitoring programme to detect meaningful changes when they are occurring.[252] If the statistical power of a monitoring programme is too low, there may be an unacceptable risk of not detecting negative changes in animal behaviour, abundance or distribution.[253] The statistical power of monitoring programmes depends on a number of factors which include the length, duration and frequency of surveys, sample sizes and characteristic of data.[254] Designing monitoring programmes that can provide data capable of distinguishing project-impacts from

[247] Fox and others, (n139), 1931-1932
[248] Robert C. Ward, Jim Loftis, Graham McBride, 'The data-rich but information poor syndrome in water quality monitoring' (1986) 10 Environmental Management, 291
[249] Bennet F., Culloch R. and Tait A., (n244), at 14
[250] Lindeboom and others, (n189), 171
[251] Ilya Maclean and others, 'Evaluating the statistical power of detecting changes in the abundance of seabirds at sea' (2013) IBIS 155, 113
[252] Le Lièvre C., O'Hagan A.M, Culloch R. Bennet F., (2016) Legal Feasibility of implementing a risk-based approach and compatibility with Natura 2000 network. RICORE project. 53pp. <http://ricore-project.eu/downloads/> (4 January 2017), at 41
[253] Ibid, at 8
[254] For a detailed discussion on statistical power of monitoring in relation to survey design: Culloch R., *et al*., (2015). Report on emerging innovative monitoring approaches, identifying potential reductions in monitoring costs and evaluation of existing long-term datasets. RiCORE Project, 61pp. <http://ricore-project.eu/downloads/> (15 February 2017)

background ecosystem variation and, accordingly, reduce uncertainty is highly challenging. In this vein, Bennet and others observe that wave and tidal energy projects are more susceptible to the risk of DRIP. The smaller spatial footprint of these project increases the difficulty that a monitoring programme has in distinguishing project-related impacts from background variation in the wider ecosystem.[255]

5.2. An overview of specific limitations of monitoring techniques

To date, ORE developers must ‘prove the negative’[256] with respect to all possible negative impacts on N2000 qualifying features. Existing monitoring techniques however present a number of limitations that significantly hamper our capacity to predict and detect changes in animal behaviour and species population. Most of observational methods to monitor wildlife on land are simply not available in, or transferrable to the marine environment.[257]

Detection probability of monitoring programmes depends on a number of factors including the spatial resolution of monitoring systems, animal behaviour and surrounding environmental conditions.[258] Collecting data in the marine environment is challenging because of limited available methods having high resolution for measuring animals’ movement and behaviour underwater.[259] The detection probability of monitoring techniques may be hampered by two processes termed ‘availability bias’ and

[255] Bennet F., Culloch R. and Tait A., (n244), 15
[256] Copping and others, (n21), at 44
[257] Douglas P. Nowacek and others, ‘Studying cetacean behaviour: new technological approaches and conservation applications’ (2016) 120 Animal Behaviour, 235
[258] Ursula Verfuss and others, ‘Comparing methods suitable for monitoring marine mammals in low visibility conditions during seismic survey’ (2018) 126 Marine Pollution Bulletin, 1
[259] Gordon D. Hastie and others, ‘Tracking Technologies for Quantifying Marine Mammals Interactions with Tidal Turbines: Pitfalls and Possibilities’ in *Humanity and the Sea: Marine Renewable Energy Technology and Environmental Interactions* (Springer, 2014), 127

‘perception bias’.[260] Verfuss explains that availability bias occurs when the presence of an animal is missed because the animal was not available for detection.[261] This is the case where an animal is present but does not emit a detectable signals. An example of availability bias is where animals underwater are not seen by visual observers or silent animals are not capable of detection by acoustic monitoring systems. ‘Perception bias’ occurs when animals are capable of detection, whether because the animal is visible at the surface or because it emits a signal, but the detection system failed to detect the cue.[262] All monitoring techniques are biased, although to different degree of severity, by these two types of bias. Using a combination of monitoring systems is therefore generally advised in the scientific literature in order to improve the detection performance of monitoring programmes.[263]

Boat-based or aerial-based visual surveys are generally used to establish baseline information on the abundance and distribution of sea birds and marine mammals.[264] Bailey *et al.*, indicate that visual surveys are unlikely to have sufficient power to detect potential changes in animal behaviour as well as fine-scale spatial and temporal variation in abundance and distribution.[265] Detection probabilities of these techniques is indeed, limited by substantial sampling biases resulting from observers’ counting errors and the inability to detect animals at night and during poor sea/weather conditions.[266] Visual surveys from boats or planes, are thus likely ‘to under-represent’ the number of marine mammals’ as these animals spend much of their time underwater with sea states

[260] Helen Marsh and D.F. Sinclair, ‘Correcting for visibility bias in strip transect aerial surveys of aquatic fauna’ (1989) 53 Journal of Wildlife Management, 1017
[261] Verfuss and others, (2018), (n258), 5
[262] Ibid, 5
[263] Hastie and others, (n259), at 137; Verfuss and others, (n258), at 1, 15
[264] MMO, (2014), (n232), at 107, 133
[265] Bailey and others, (n136), 7
[266] Cormac G. Booth, ‘Challenges in using Passive Acoustic Monitoring in High Energy Environment: UK Tidal Environment and Other Case Studies’ in Popper N.A., Hawkins A., (eds.) *The effects of noise on aquatic life II* (Springer, New York, 2016), 101

significantly influencing detection probability. [267] Waggit *et al.,* evaluated the efficiency of shore-based surveys and demonstrated that shore-based surveys are hampered by low observer's ability to detect foraging birds away from coastlines.[268] Recent technological advancements in radar systems or digital (camera) surveys may provide more detailed assessments of avoidance behaviours and collision risks of sea birds around offshore wind turbines. These techniques may provide more accurate records of seabird flight height than visual surveys.[269] However, data collected by radar surveys do not allow identification of species and therefore, they must still be validated by field observations/visual surveys.[270] Acoustic monitoring may have greater statistical power than visual surveys to detect potential changes in marine mammals abundance and distribution[271] and fine-scale interactions with operating turbines. Marine mammals, and more particularly seals, are known to use acoustic cues to navigate, communicate and forage.[272] This technique is known as echolocation where acoustic signals emitted reflect off of the targets and the returning echo provides animals with information on the surrounding environment.[273] Passive Acoustic Monitoring (PAM) is commonly used to detect vocalizing marine mammals using hydrophones. Compared to visual surveys, PAM provides cost-effective and continuous monitoring resulting in data on trends in species presence and species identity at any time (day/night) including in poor sea or weather conditions.[274] Vocalization may also provide pertinent information on behavioural state of the animals being monitoring (i.e. foraging, migrating and

[267] Triton Offshore Wind Farm Ltd. (2015). Environmental Statement Vol. 2., Chapter 6 Marine Mammals (April 2015, Revision A), para.6.38, at 10; Orsted Power Ltd (2018), Horn Sea Project Three Offshore Wind Farm. Environmental Statement, Volume 5, Annex 4.1. Marine Mammals Technical Report (May 2018, Report Number: A6.5.4.1), at 19
[268] James Waggit, Paul A. Bell and Beth Scott, 'An evaluation of the use of shore-based surveys for estimating spatial overlap between deep-diving seabirds and tidal stream turbines' (2014) 8 International Journal of Marine Energy, 36
[269] MMO (2014), (n232), at 134
[270] Aonghais Cook and others, 'Quantifying avian avoidance of offshore wind turbines: Current evidence and key knowledge gaps' (2018) 140 Marine Environmental Research, 278, 286
[271] Bailey and others, (n136), 7
[272] Chloe E. Malinka and others, 'First in situ passive acoustic monitoring for marine mammals during operation of tidal turbine in Ramsay Sound, Wales' (2018) 590 Marine Ecology Progress Series, 247
[273] Nowacek and others, (n257), 236
[274] Malinka and others, (n272), 248

socialising).[275] PAM systems are nonetheless subject to limitations relating to operating frequencies, discretion and directionality of vocalization by marine mammals.[276] Animals will remain undetected if they do not vocalise continuously. Likewise, some vocalizations are highly directional which means that projected sound only propagates in narrow beams.[277] PAM systems are likely to suffer from low detection probability if hydrophones are not within the beam of acoustic signals produced by marine mammals.[278] Another notable limitation results from limited knowledge of vocal rates of species, making it difficult to identify the species group of detected animals.[279] Active Acoustic Monitoring (AAM) is a more invasive method of echolocation where sound pulses are emitted into the water using a sonar projector and the system listens to the acoustic reflections of this pulse from an animal by means of hydrophones.[280] AAM can track animals that do not echolocate or echolocate or happen not to emit vocal signals (i.e. harbour porpoises or dolphins).[281] AAM can provide fine-scale data on the movement of animals around turbines but also suffers from limited spatial detection range and poor capacity to classify detected animals down to species.[282] Environmental conditions such as bathymetry, high sea states and surrounding anthropogenic noise significantly alter the detection performance of PAM and AAM by degrading the intensity of animals' signals.[283]

Other techniques such as telemetry are widely used for monitoring sea birds and pinnipeds around both OWFs and ORE sites. Telemetry consists of 'tags that are

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[275] Nowacek and others, (n257), 236
[276] Daniela Maldini, 'The Importance of a Multi-Method Monitoring Approach to Assess the Effects of Anthropogenic Activity on Harbour Porpoises' (Conference paper, European Wave and Tidal Energy Conference Series, 27th August, 1st September 2017), at 2
[277] Verfuss and others, (n258), 10
[278] Ibid.
[279] Nowacek and others, (n257), 236
[280] Verfuss and others, (n258), 2
[281] Malinka and others, (n272), 248
[282] Hastie and others, (n259), 137; Malinka and others, (n272), 248
[283] Verfuss and others, (n258), 10

attached to individual animals allowing for data on their movements and behaviour to be transmitted to a receiver or downloaded directly from the tag after recovery'.[284] Tagging is easier for pinnipeds and seabirds as these animals breed onshore where they can be captured and tagged. A key limitation of telemetry is that data sets are short-term and less is known about animal behaviour outside breeding seasons.[285] Findings from a recent telemetry study around the SeaGen tidal turbine indicate that the duration of tags deployments is very short (up to 10 days) and tagging operations must therefore be repeated many times throughout the breeding season with the risk that different animals are being tagged each year.[286] At SeaGen, Savidge explains that, even though it was presumed that the same representative sample of animals was tagged each year, it was not possible to precisely track individual responses to the presence of the turbine.[287] Moreover, only a limited number of animals could be tagged due to challenges in catching them.[288] This clearly limits the ability to measure consistent behaviour changes in the same animal and to determine whether these variations can be attributed to a potential development. This also means that sample sizes are likely to represent a very limited portion of the entire population, making the evaluation of potential population-level impacts almost impossible.[289]

Additionally, no standards or methodologies for measuring EMF impacts in the underwater environment are currently available to developers.[290] Gill *et al.*, stress that there is an important 'lack of clarity and high uncertainty relating to what should be monitored and which methodology and scale of monitoring is appropriate' to assess the

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[284] Hastie and others, (n259), at 128
[285] Fox and others, (n139), 1930
[286] Sparling, Lonergan and McConnell, (n195), at 199
[287] Savidge and others, (n196), 161
[288] Ibid, 197
[289] Hastie and others, (n259), at 130, 137
[290] Thomsen and others, (2015), 'MARVEN', (n169), at 11, 41; Copping and others, (2016), (n21), 122

impacts of EMF.[291] So far, they argue that 'no monitoring activities at OWFs have been inadequate because no monitoring has had enough statistical power to detect EMF impacts on key sensitive species'.[292]

Overall, monitoring techniques will slightly differ depending on the ORE technology deployed. There are differences between wave/tidal energy and OWFs in terms of resolution of data needed to assess risks with marine wildlife.[293] Wave and tidal energy are still in their infancy and therefore monitoring priorities have concentrated on understanding fine-scale behavioural reactions of protected marine species around single devices.[294] This evaluation requires high-resolution data at fine-spatial scale to understand the interactions of animals with single devices.[295] At this stage, a critical challenge to move towards commercialisation is to monitor and determine collision risks/encounter interactions of fish, birds and marine mammals with moving components of ocean energy devices.[296] Most current monitoring approaches lack the resolution to be able to examine such close-range behaviours and determine whether collisions are taking place.[297] The State of the Science Report states that a number of monitoring methods have been suggested to observe marine mammals and fish behaviour around devices at close-range, but none have been demonstrated to actually work in energetic tidal and wave environments.[298] Wave and tidal energy devices are installed in high-energy environments where monitoring technologies are difficult to operate. The use of unmanned environmental monitoring platforms (i.e. fixed or moving remotely controlled vehicles) carrying multiple monitoring devices (cameras, sonars and

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[291] Gill and others, 'Marine Renewable Energy, Electromagnetic', (n166) at 74
[292] Ibid.
[293] Roche and others, 'Research priorities', (n203), 1334
[294] Rollings E., Donovan C., Eastham C., (2016). Meygen Tidal Energy Phase 1 Project Environmental Monitoring Programme. Report by Meygen. 21pp. <https://tethys.pnnl.gov/publications/meygen-tidal-energy-project-phase-1-project-environmental-monitoring-programme>, (15 February 2017), at 5
[295] Roche and others, (n203), 1334
[296] Copping and others, (2018), (n192), 8
[297] Copping and others, (2016), (n21), 48
[298] Ibid, at 44 and 62

sediment traps) has increased in an effort to overcome survivability issues associated with traditional monitoring techniques.[299] Camera, hydrophones and multi-beam sonars are usually mounted on monitoring platforms. They enable detection, tracking and observation of fine-scale behavioural responses of fish, diving sea birds and marine mammals around single devices. The most commonly used monitoring systems so far involve PAM (hydrophones), shore-based, aerial and boat-based survey, telemetry, video camera and active acoustic monitoring using multi-beam sonars.[300] These systems are subject to similar detection limitations identified above. Copping *et al.*, point out that PAM and AAM may provide information about how animals behave around devices but do not have enough resolution to determine whether there is physical contact between animals and devices.[301] Monitoring findings at SeaGen suggest that active sonar systems were found to be able to detect marine mammals in tidally turbulent conditions but few systems have spatial and temporal resolution, range and detection capabilities of the systems was insufficient to track animal movements.[302] Hastie further stressed that it was impossible to detect and track animals immediately downstream of the SeaGen turbine because of the turbulence produced by it.[303] The ambient environment including wind generated whitecap on the surface and density variation in the water column also have had a significant effect on the quality of acoustic data.[304] Findings of a recent PAM survey, consisting of twelve hydrophones directly mounted on the Delta Stream tidal energy turbine (Ramsay Sound), has nonetheless indicated that the PAM system could, successfully and almost continuously,

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[299] Anke Bender, Jan Sundberg and Francisco Francisco, 'A Review of Methods and Models for Environmental Monitoring of Marine Renewable Energy' (Proceedings of the 12th European Wave and Tidal Energy Conference, 27th August- 1st September 2017, Cork, Ireland), at 3

[300] Copping and others, (n21), at 31; See also monitoring programmes: Keenan G., and others, (2011). SeaGen Environmental Monitoring Programme: Final Report. Report by Royal Haskoning. 81pp. <https://tethys.pnnl.gov/publications/seagen-environmental-monitoring-programme-final-report>, (20 March 2017), at 21-22, 71

[301] Copping and others, (n21), 44

[302] Hastie and others, (n259), 133

[303] Ibid.

[304] Ibid.

track the movements of small cetaceans around the turbine.[305] The limited duration of turbine operation also meant that sufficient data could not be collected to understand the effect of turbine rotation on animal presence and movement.[306] Noise measurement methodologies are particularly challenging to operate due to high ambient noise in dynamic wave and tidal environments and the large variation in technological designs of wave and tidal energy devices.[307] The ambient noisy environment was also reported to significantly degrade the quality of datasets resulting in significant monitoring time loss.[308] Underwater noise from single devices can be measured[309] but the lack of common technological design inhibits comparison of data sets.[310] However, no measurement standards exist to measure acoustic noise of commercial-scale arrays.

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[305] Malinka and others, (n272), 261

[306] Ibid.

[307] Paul A. Lepper, Stephen P. Robinson, 'Measurement of Underwater Operational Noise Emitted by Wave and Tidal Stream Energy Devices' in Popper N.A., Hawkins A., (eds.) *The effects of noise on aquatic life II* (Springer, New York, 2016), 615-622

[308] Copping and others, (n21), at 90; Cormac G. Booth, (2016), 'Challenges in using Passive Acoustic Monitoring', (n266), at 106-107

[309] Copping and others, (2018), (n192), 7

[310] Lepper and Robinson, (2016), (n307), 619

6- Concluding remarks

This Chapter has demonstrated that scientific uncertainty can never be completely eradicated.[311] As rightly explained by Fisher in her writings, scientific uncertainty is rarely due to 'a simple need to do more research'.[312] 'Scientific uncertainty is shorthand for a whole series of methodological, epistemological and ontological problems'.[313] These logical flaws hold particularly true in the marine environment. Marine ecosystems are characterised by complex interactions and non-linear dynamics which are not properly understood by the scientific community. The fluid nature of marine ecosystems, combined with the large dispersal range and natural variation of marine organisms place important scale-related limitations on our capacity to predict and establish cause-effect relationships between a particular development and observed changes in valued receptors. Consequently, monitoring in the marine environment commonly suffers from low detection probability. More information does not necessarily exclude or reduce risks. Limitations in observation techniques mean that data input and parameters that are utilised in predictive scientific models may generate imprecise modelling outputs and fail to remove risks. Minor uncertainties caused by a margin of error may thus delay licensing processes even when the environmental risks posed are relatively low.

With respect to wave and tidal energy devices, there are also specific technological barriers that are explicitly related to the survivability and resolution of monitoring tools in high energetic sea conditions. These issues significantly hamper accurate impact predictions about single devices and may curtail the development rate of the entire ocean energy sector.

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311 Elisabeth Fisher, Bettina Lange, Eloise Scotford E (eds.). *Environmental Law: Text, Cases, and Materials* (Oxford University Press, 2013), 40

312 Elisabeth Fisher, 'Drowning by numbers: Standard setting in risk regulation and the pursuit of accountable public administration' (2000) 20 (1) Oxford Journal of Legal Studies, 109, 115

313 Ibid, 115

Given the current paucity of empirical data and existing shortcomings in scientific methods, it is clear that best scientific knowledge has not been fully achieved yet and as such, it is not available to developers of ORE technologies. Lawyers should fully understand the limitations of science in characterising complex ecological risks associated with expanding the ORE industry. Scientific uncertainty should not open the door to strict protectionism against technologies that have promising benefits for climate change mitigation. In particular, the problem of scientific uncertainty will never be solved if one remains wedded to an approach that exclusively aims at avoiding ecological risks. In this vein, the author agrees with Lee who states that 'the inevitable fact' of scientific uncertainty 'should never be used as rhetorical device to stymie action'.[314] Instead, 'in terms of practical decision-making, uncertainty is always important, since it emphasises the need for flexible, adaptive approaches to governance'.[315] Since there will always be a need to act on limited science, the author will argue that a more innovative and 'science-based' approach to application of the precautionary principle[316] that facilitates adaptive management is warranted to achieve structured certainty where such a 'desirable ideal' does not exist. Solutions and practical recommendations to do so will be proposed in Chapter VI. In the meantime, Chapter IV will use the findings of this Chapter to analyse and constructively critique the way the CJEU and domestic Courts have traditionally dealt with scientific uncertainty under the AA process of the Habitats Directive.

[314] Maria Lee, (ed.) *EU Environmental Law, Governance and Decision-Making* (vol. 43., Modern Studies in European Law, 2014), 38
[315] Ibid.
[316] Charles Weiss, 'Scientific uncertainty and Science-based precaution' (2003) 3 International Environmental Agreements: Politics, Law and Economics, 137

CHAPTER IV

JUDICIAL INTERPRETATION OF THE HABITATS DIRECTIVE

AN UNSURMOUNTABLE OBSTACLE FOR OFFSHORE RENEWABLE ENERGY DEVELOPERS

1 – Introduction

This Chapter offers a strong critique of the particular interpretation of the precautionary principle by the Court of Justice of the European Union (CJEU) under the appropriate assessment (hereafter: AA) of the Habitats Directive. The CJEU plays a key role in ensuring that European Union (EU) law is observed in the interpretation and application of the Treaties.[1] The Court has given an important doctrinal role to the precautionary principle in interpreting the requirements for an AA under Article 6(3) of the Habitats Directive. As briefly discussed in the Introduction, Article 6(3) has been interpreted in such a way that before granting development consents, licensing authorities must be satisfied beyond all reasonable scientific doubt that projects will not create a significantly impact upon the integrity of Natura 2000 sites (hereafter: N2000).[2] In its most recent case law,[3] the Court has steadfastly reiterated its position in *Commission v.*

[1] Consolidated version of the Treaty on the European Union [2012] OJ C 326/13 (hereinafter TEU), Article 19(1)

[2] Case C-127/02 *Landelijke Vereniging tot Behoud van de Waddenzee and Nederlandse Vereniging tot Bescherming van Vogels v Staatssecretaris van Landbouw, Natuurbeheer en Visserij (Waddenzee)* [2004] ECR I-07405, paras.57, 59-61

[3] Case C-441/17 *European Commission v Republic of Poland* [2018] ECLI:EU:C: 2018:255, para.120; Case C-142/16 *Commission v. Germany (Moorburg)* [2017] ECLI:EU:C: 2017:301, para.42

Portugal[4] to note that it is at the time of decision-making that the legal test of no reasonable scientific doubt must be satisfied. As a matter of course, there is no guidance on what constitutes 'no reasonable scientific doubt'. Commentators have already cautioned against such a dogmatic approach to biodiversity conservation also referred to as "deathbed" approach to biodiversity conservation.[5] Such a high standard of proof, reminiscent of criminal law, is extremely difficult to establish in dynamic marine environments, particularly in the context of novel and untested ORE technologies where data and scientific evidence are still being collected. This holds particularly true for wave and tidal energy projects given the nascent nature of these technologies. As discussed in Chapters II and III, knowledge of the ecological effects of OWFs has been steadily increasing as empirical evidence from commissioned wind farms is accumulating. Ocean energy devices however, are still in a pre-commercial stage.[6] The magnitude and nature of the potential impacts of these nascent technologies on marine ecosystems is still poorly understood due to limited experience of full-scale deployments.[7] Evaluating the full effects of ocean energy technologies on N2000 sites and their qualifying features may not be possible until the first arrays of turbines are authorised, deployed and monitored in real-sea conditions. As we approach the first array deployments of tidal turbines, a rigidly applied precautionary principle may paradoxically restrict the value of innovative renewable energy technologies with higher capital costs than well-established conventional energy systems.

[4] Case C-239/04 *Commission v Portugal* [2006] ECR I-10199, para 24

[5] Hendrik Schoukens and Ann Cliquet, 'Biodiversity offsetting and restoration under the European Union Habitats Directive: balancing between no net loss and deathbed conservation?' (2016) 21 (4) Ecology and Society, 572

[6] Andrea Uihlein, Davide Magagna, 'Wave and tidal current energy – A review of the current state of research beyond technology' (2016) 58 Renewable and Sustainable Energy Review, 1070

[7] Copping A., and others (2016). Annex IV 2016 State of Science Report: Environmental Effects of Marine Renewable Energy Development around the World. 224pp.

There is a need to diversify our renewable energy portfolio. As discussed in the introduction to this thesis, up-scaling wind energy development is becoming more difficult due to the scarcity of locations with appropriate wind exposure.[8] Terrestrial wind energy developments face increasing public opposition characterised by the so-called 'Not In My Back Yard' (NIMBY) objection.[9] New forms of renewable energy must be deployed offshore. Offshore wind energy is certainly the most mature and viable renewable energy technology deployed at sea but it provides an intermittent source of energy with variable returns on investment. Wave and tidal energy present a number of advantages compared to wind energy. In particular, wave energy and tidal stream devices come with fewer visual impacts and ensure predictable and continuous renewable energy output produced from the action of waves and current flows.[10] The Court should therefore be careful not to impose unrealistic requirements for certainty as this may restrict opportunities to diversify our energy mix portfolio to include novel forms of renewable energy technologies such as wave and tidal energy systems.

Chapter IV does not intend to challenge the utility or legitimacy of the precautionary principle nor does it intend to challenge the Habitats Directive. Likewise, the objective of this study is not to give a systematic 'green pass'[11] to ORE technologies. Instead, Chapter IV aims to highlight the difficulties that an inflexible precautionary principle under the AA of the Habitats Directive creates in terms of burden of proof imposed on developers of ORE technologies. The CJEU has not had the opportunity to confirm the application of the strict precautionary standards of Article 6(3) in cases involving

[8] Edward Willsteed and others, 'Obligations and aspirations: A critical evaluation of offshore wind farm impact assessments' (2018) Renewable and Sustainable Energy Reviews, 2332

[9] John K. Kaldellis and others, 'Environmental and social footprint of offshore wind energy. Comparison with onshore counterpart' (2016) 92 Renewable Energy, 543

[10] Alistair L. Borthwick, 'Marine Renewable Energy Seascape' (2016) 2 (1) Engineering, 69

[11] Ralph Frins and Hendrik Schoukens, 'Balancing wind energy and nature protection: From policy conflicts towards genuine sustainable development?' in Squintani, L.; Vedder, H.H.B. (ed.), *Sustainable energy united in diversity. Challenges and approaches in energy transition in the European Union* (Leipzig, European Environmental Law Forum, 2014), 85

permissions for ORE developments. In this regard, this analysis anticipates what could be the consequences of applying the inflexible precautionary standards of the Court in permitting procedures for offshore renewables. Using the onshore and the ORE sector as case-studies, the author raises the important question of how realistic the application of the precautionary principle prescribed by the CJEU is in the context of ORE developments.

2 - A 'criminal-like' standard of proof under Article 6(3) of the Habitats Directive

2.1. Preliminary remarks on the status of the precautionary principle

The precautionary principle was universally accepted in Rio de Janeiro at the 1992 UN Conference on Environment and Development. Principle 15 of the Rio Declaration provides the most cited iteration of the precautionary principle and refers to precaution as an 'approach' rather than as a 'principle' of law:

> 'The precautionary approach shall be widely used by States according to their capabilities. Where there are threats of serious or irreversible damage [to the environment], lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation'.[12]

Since then, the precautionary principle has been incorporated in various environmental law treaties, conventions and soft law instruments.[13] Despite this, the status of the precautionary principle, and more particularly its place as a norm of customary

[12] Declaration on Environment and Development (UNGA Doc. A/CONF.151/16/Rev.1 1992, 14 June 1992) (Rio Declaration), Principle 15

[13] For example, Convention on Biological Diversity (adopted 5 June 1992, entered into force 29 December 1993) 1760 UNTS 79, Preamble; United Nations Framework Convention on Climate Change (adopted 9 May 1992, entered into force 21 March 1994) 1771 UNTS 107, Article 3(3); Convention on the Protection of the Marine Environment in the North East Atlantic (adopted 22 September 1992, entered into force 25 March 1998) 2354 UNTS 67, Preamble, Article 2(2)

international law, is still discussed in the legal doctrine.[14] MacDonald argues that the label of 'principle' or 'approach' defines the 'parameters of the current debate' over the status of the principle'.[15] Trouwborst and Hey argue that the difference of terminologies is devoid of legal meaning insofar as the two terms are used interchangeably in various international instruments and as such, the two formulations would have the same characteristics.[16] Regardless of this semantic distinction, Trouwborst found that the core elements of the principle have attained the status of a general principle of International law and a customary norm.[17] A trend towards recognition of a customary status to the precautionary principle[18] seems to have emerged among environmental scholars.[19] The formulation of precaution as an 'approach' or a 'principle' may still have a significant bearing for the remainder of this analysis. At first glance, principles are endowed with a higher degree of legal strength and normative content. Peel notes that 'precaution' as a principle would create a positive obligation to take protective measures where a potential risk of harm cannot be retired or verified on the basis of scientific knowledge.[20] As an approach, 'precaution' would give greater flexibility to regulators to take protective measures in certain circumstances depending on their appreciation of

[14]Arie Trouwborst, 'The Precautionary Principle in General International Law: Combating the Babylonian Confusion' (2007) 16(2) RECIEL, 185; Ole W. Pedersen, 'From Abundance to indeterminacy: The Precautionary Principle and its Two Camps for Custom' (2014) 3 Transnational Environmental Law, 323

[15] John Macdonald, 'Appreciating the precautionary principle as an ethical evolution in ocean management' (1995) 26(3) Ocean Development and International Law, 255, 256

[16] Arie Trouwborst, *Precautionary Rights and Duties of States* (1st edn, Martinus Nijhoff Publishers, 2006), 12; Hey Ellen, 'The Precautionary Concept in Environmental Policy and Law: Institutionalizing caution' (1992) 303 Georgetown International Environmental Law Review, 303, 304

[17] Arie Trouwborst, *Evolution and Status of the Precautionary Principle in International Law* (Kluwer Law International, 2002), 33-286

[18] The Seabed Dispute Chamber of the International Tribunal for the Law of the Sea observed that the incorporation of the precautionary principle into a 'growing number of international treaties and other instruments' has 'initiated a trend towards making this approach part of customary international law'. ITLOS, *Responsibilities and Obligations of States Sponsoring Persons and Entities with Respect to Activities in the Area* (Advisory Opinion of 1st February 2011), para. 135. <https://www.itlos.org/cases/list-of-cases/case-no-17/>

[19] Owen McIntyre and Thomas Mosedale, 'The Precautionary Principle as a norm of Customary International Law' (1997) 9(2) Journal of Environmental Law, 241; Nicolas De Sadeleer, *Environmental Principles: From Political Slogans to legal Rules* (Oxford University Press, 2002), 92; Philippe Sandin and Jacqueline Peel, *Principles of International Environmental Law* (3rd edn, Cambridge University Press, 2012), 228

[20] Jackeline Peel, 'Precaution – a matter of principle, approach or process?' (2004) 5 (2) Melbourne Journal of International Law, 483, 491

uncertainty and the seriousness of potential harms.[21] In a similar vein, MacDonald considers that precaution as an 'approach' offers more flexibility 'to guide future policies' and give more weight to technological, social and economic considerations.[22] Depending on the interests at stake, MacDonald argues that a 'stringent principle' may be preferable, while in other contexts, 'an open-ended approach may be necessary'.[23] Without necessitating a particular decision, precaution as a 'principle' may thus carry with it a duty to take more protective actions, including regulatory prohibitions,[24] and stands as a presumption in favour of environmental protection in the face of uncertainty.

The focus here is on the application of the precautionary principle in EU biodiversity law. At the EU level, the status of the precautionary principle, although not the exact contour of its implementation, has been defined with greater clarity. The principle is entrenched under the Treaty on the Functioning of the European Union (TFEU) as a guiding principle of the environmental policy.[25] The CJEU has also explicitly enshrined the precautionary principle as a general principle of European Union law.[26] Consistent with its status as a general law principle, the precautionary principle applies outside the environmental sphere across a wide range of policy areas including energy policy (section 2, Chapter V). As such, the precautionary principle has been applied with varying degrees of weight by European courts.[27] Discrepancies in its implementation have been justified by the fact that its application across a wide range of policies has been rather 'contextual'.[28] It is worth noting that variation and flexibility depending on particular circumstances is not specific to the precautionary principle but rather a

[21] Ibid.
[22] Ibid, 256
[23] Ibid.
[24] Ibid.
[25] Consolidated version of the Treaty on the Functioning of the European Union [2012] OJ C 326/49 (TFEU), Article 191(2)
[26] Case C-132/03 *Ministero della Sallute* [2005] ECR I-04167, para.35
[27] Ragnar Lofstedt, 'The precautionary principle in the EU: Why a formal review is long overdue' (2014) 16(3) Risk Management, 137
[28] Nicolas De Sadeleer, 'The Precautionary Principle in EU Law' (2010) 5 AV*&S*, 173

common feature to the application of all legal principles.[29] Broadly speaking, the level of precaution has been primarily influenced by the interest being threatened and the standard of protection set out in secondary law ranging from weak to strong application of the principle.[30] Hence, a weak application of the precautionary principle is commonly characterised by a high threshold of scientific evidence to invoke precautionary measures and a preference for risk management.[31] Conversely, Garnett and Parsons argue that a strong precautionary principle is characterised by 'a lower epistemic threshold of uncertainty and tends toward risk prevention' even if there are only weak grounds for believing that a project may be harmful.[32] In its strongest formulation, the precautionary principle epitomises the rationales for proactive restrictions or prohibitions in the face of uncertain ecological impacts. Trouwborst better summarises this approach 'as erring on the side of caution, in favour of the environment, giving the environment the benefit of the doubt, or put another way, "*in dubio pro natura*"'.[33] This is exactly the interpretation of the precautionary principle that the CJEU contemplates when interpreting the requirements of the 'appropriate assessment' under the Habitats Directive.

[29] Elizabeth Fisher, 'Precaution, Precaution Everywhere: Developing a Common Understanding of the Precautionary Principle in the European Community' (2002) 9 Maastricht Journal of European and Comparative Law, 7, 16

[30] Kenisha Garnett and David D. Parsons, 'Multi-Case Review of the Application of the Precautionary Principle in European Union Law and Case Law' (2016) Risk Analysis, 502

[31] Ibid, 505

[32] Ibid.

[33] Arie Trouwborst, *Precautionary Rights and Duties of States* (1st edn, Martinus Nijhoff Publishers, 2006), 29. *'In dubio pro natura'* is one of the thirteen principles adopted by the IUCN World Declaration on the Environmental Rule of Law to promote ecologically sustainable development. It expresses the premise that 'in case of doubt, all matters shall be resolved in a way most likely to favour the protection and conservation of the environment' (Principle 5). Although the principle '*in dubio pro natura'* does not have legally binding force in international law, Trouwborst argues that it reflects 'the gist of the precautionary principle in general international law'. See: Arie Trouwborst, 'Prevention, Precaution, Logic and Law' (2009) 2(2) Erasmus Law Review, 105, 110

2.2. Protection rules of Article 6(3) and Article 12 of the Habitats Directive

The Habitats Directive lists nine marine habitats types and 16 marine species for which Special Areas of Conservation (SACs) are required.[34] The Birds Directive lists 60 species of seabirds whose conservation requires designation of Special Protection Areas (SPAs).[35] SPAs must also be designated to ensure survival and reproduction of all regularly occurring migratory species not listed in the Birds Directive.[36] Representative species of marine mammals protected by the network of N2000 sites include *inter alia*: the harbour porpoise (*Phocoena phocoena*), the harbour seal (*Phoca vitulina*), the grey seal (*Halichoenus grypus*) and the bottlenose dolphin (*Tursiops truncates*).[37]

Under Article 6(3) of the Habitats Directive, any ORE project located in the vicinity of a N2000 site and that is likely to have a significant effect thereon, either individually or in combination with other projects, must be subject to an AA of its implication in view of the site's conservation objectives. Competent national authorities are to authorise a development only if they have made certain that it will not adversely affect the integrity of the N2000 site concerned. If the findings of the AA conclude that a development is likely to have a significant impact on the integrity of a designated site, then that development cannot go ahead, unless it meets the criteria of Article 6(4). The derogation scheme of Article 6(4) applies when, despite a negative AA, and in the absence of alternatives, the project must nevertheless be carried out for imperative reasons of overriding public interest (IROPI).[38] The AA process necessitated by Article 6(3) and (4) of the Habitats Directive applies *mutatis mutandis* with respect to the SPAs

[34] Habitats Directive, Article 3(1) Annexes I and II
[35] Directive 2009/147/EC of 30 November 2009 on the conservation of wild birds (Birds Directive) [2009] OJ L20/7, Article 4(1) (2)
[36] Ibid.
[37] Appendix 2 Lists of existing marine Habitat types and Species for different Member States. <http://ec.europa.eu/environment/nature/natura2000/marine/index_en.htm> (accessed 15 March 2017)
[38] Habitats Directive, Article 6(4)

designated under the Birds Directive.[39] Pursuant to Article 4(1) and (2) of the Birds Directive, SPAs must be designated by Member States to ensure survival and reproduction of bird species listed in Annex I and all regularly occurring migratory bird species not listed in Annex I of the Birds Directive.[40] This means that ORE projects likely to have a significant effect on a designated SPA, shall similarly be subject to an AA of Article 6(3) of the Habitats Directive.

Article 12(1) of the Habitats Directive affords strict protection to European Protected Species (EPSs) listed in Annex IV (a) against deliberate capture, killing of specimens, b) disturbance of species, particularly during the period of breeding and migration, c) deliberate destruction or taking of eggs and d) deterioration and destruction of their breeding and resting places. The strict protection regime of Article 12 concerns all cetacean species and a number of fish and turtle species including the Green sea turtle (*Chelonia mydas*), the hawksbill sea turtle (*Eretmochelys imbricata*) and the Loggerhead sea turtle (*Caretta caretta*).[41] Any new ORE development which is liable to adversely disturb these species or to destroy and, or deteriorate their breeding or resting sites must be subject to 'strict scrutiny'.[42] Unlike the AA process of Article 6(3), the CJEU has not prescribed any standard of proof for the purpose of informing an assessment under the strict protection regime of Article 12 (1). However, a twofold regime of protection is applicable to marine species listed under both Annex II and Annex IV (a) of the Habitats Directive.[43] This concerns harbour porpoises (*Phocoena*

[39] Directive 2009/147/EC of 30 November 2009 on the conservation of wild birds (Birds Directive) [2009] OJ L20/7
[40] Habitats Directive, Article 7
[41] Habitats Directive, Annex IV(a)
[42] Charles George and David Graham, 'After Morge, where are we now? The Meaning of "Disturbance" in the Habitats Directive' in Jones G. (ed.) *The Habitats Directive: A Developer's Obstacle Course?* (Hart Publishing, 2012), at 45-51
[43] European Commission, 'Guidance document on the strict protection of animal species of Community interest under the Habitats Directive 92/43/EEC' (final version February 2007). <http://ec.europa.eu/environment/nature/conservation/species/guidance/index_en.htm> (10 March 2017), at 15-16

phocoena) and bottlenose dolphins (*Tursiops truncates*). These species are protected by a dual regime of protection for their natural habitats under Articles 6(1)-(4) and a strict protection system against death, physical injuries, disturbance and deterioration of key functional places under Article 12(1).[44] The protection schemes of Articles 6 and Article 12(1) will therefore overlap, when for example, breeding sites and resting places are already designated as N2000 sites. This means that where a project is likely to have a significant effect on a site designated for an Annex II and IV (a) species, the assessment process shall satisfy the requirements of both Article 6(3) and Article 12(1) in order to avoid any double assessment.[45] The AA process of Article 6(3) and the judicial interpretation of the precautionary principle based thereon are thus equally applicable to N2000 sites hosting 1) sea birds species listed under Annex I of the Birds Directive and regularly migratory species of sea birds, as well as 2) marine species listed exclusively under Annex II and species listed under both Annexes II and IV (a) of the Habitats Directive.

[44] Ibid, at 16. The EC guidance on Article 12 explains that the regime of Article 6(1) - (4) 'has a much more intensive and broader task which aims at maintaining and where needed, restoring the entire habitat of a species at certain site. The provisions of Article 12 concentrates on preventing negative effects on the most central of such habitats, in particular those that are essential to guarantee successful breeding and resting'.
[45] Ibid.

2.3. Setting the legal context for ORE permitting under the Habitats Directive

The Habitats Directive does not specifically refer to the precautionary principle for the purpose of Article 6(3). The *Waddenzee* case[46] is seminal in this respect in that it clarifies the nature of the precautionary principle that is to be applied to the authorisation of ORE projects. In *Waddenzee*, the CJEU endorsed a strong application of precautionary principle, requiring a very low threshold of scientific evidence to carry out an AA and prohibition of new development in the face of scientific uncertainty.

The trigger to carry out an AA is a 'very light' one.[47] The precautionary principle applies for this purpose. Any renewable energy project that is 'likely' to have a significant effect' on a N2000 site, shall be subject to AA of its implication for the site in view of the site's conservation objectives. 'Likely' constitutes the threshold at which an AA is required under Article 6(3) of the Habitats Directive. The CJEU subordinates the requirement for an AA to the condition that there is a mere 'probability or a risk' of significant effect on a N2000 site.[48] The CJEU held that 'in light of the precautionary principle, such a risk exists if it cannot be excluded on the basis of objective information that the plan or project will have significant effects on the site concerned'.[49] 'In case of doubt, an AA must be carried out'.[50] 'Likely' therefore refers to the probability of occurrence of a significant effect and not to the nature of the potential damage. In this respect, one may wonder when a potential effect on N2000 sites is 'significant' enough to require an AA. With respect to the EIA Directive, Arabadjeva argues that 'significant effect' is an 'open-ended' and 'vague standard which does not

[46] Case C-127/02 *Waddenzee* [2004] ECR I-07405
[47] European Commission, 'Study on the precautionary principle in EU environmental policies' (final report, November 2017) <https://publications.europa.eu/en/publication-detail/-/publication/18091262-f4f2-11e7-be11-01aa75ed71a1/language-en> (20 April 2017), at 21
[48] *Waddenzee*, (n46), para.43
[49] Ibid, para.44
[50] Ibid.

provide clear guidance as to the precise point at which a legal obligation to conduct an EIA is triggered'.[51] According to Arabadjeva, the 'semantic uncertainty' of the term leaves the decision-maker ample room for discretion in determining whether an environmental assessment under the EIA Directive shall be required, 'creating a degree of legal uncertainty' for those affected by such a legal requirement.[52] Under the Habitats Directive, the CJEU addressed this legal gap, clarifying the nature and purpose of the screening process triggering an AA process as follows:

> […] Where a plan or project not directly connected with or necessary to the management of a site is likely to undermine the site's conservation objectives, it must be considered likely to have a significant effect on that site. The assessment of that risk must be made in the light inter alia of the characteristics and specific environmental conditions of the site concerned by such a plan or project'.[53]

A *contrario*,

> 'Where such a plan or project has an effect on that site but is not likely to undermine its conservation objectives, it cannot be considered likely to have a significant effect on the site concerned'.[54]

AG Kokott clarified this ruling by holding that, in principle any adverse effect on the conservation objectives must be regarded as having a significant effect on the site.[55] In a similar thought, AG Sharpston contends that 'the possibility of there being a significant effect on the site will generate the need for an appropriate assessment'.[56] There is no need to establish such an effect – it is merely necessary to determine that

[51] Kalina Arabadjieva, 'Vagueness and Discretion in the scope of the EIA Directive' (2017) 29 Journal of Environmental Law, 417, 418
[52] Ibid.
[53] *Waddenzee*, (n46), para.49
[54] Ibid, para.47
[55] *Waddenzee*, Opinion of Advocate General Kokott, 29 January 2004, para.84-85
[56] Case C-258/11 *Sweetman*, Opinion of AG Sharpston, 22 November 2012, para.47-49

there may be such an effect.[57] In other words, where a possibility exists that an ORE project may adversely affect the conservation objectives of the site either by causing a total loss of habitat type or species or by deteriorating such habitats, disturbing or diminishing the number of species for which the site has been designated, an AA shall be conducted. As Verschuuren rightly notes, the CJEU has placed a 'strong emphasis' on the precautionary principle for the purpose of screening.[58] AG Sharpston argues that the requirement for the effects in question to be 'significant' lays down a '*de minimis* threshold' excluding plans and projects with no 'appreciable effect on the site'.[59] In practice however, avoiding the assessment procedure of Article 6(3) will be very difficult, if not impossible, for novel technologies.[60] There is no way to prove that the effects of a new proposal will not be significant where the consequences of such a proposal are not known due to scientific uncertainty. An AA is therefore likely to be systematically required in future authorisations for ORE projects anyway. For this reason, some authors consider that the Court 'has rendered discussion of the word 'significant' purely academic'.[61]

The conclusions of the AA shall inform the question of whether a project will have an adverse effect on the integrity of marine N2000 sites. This stage of the procedure is hereby referred to as the 'integrity test' of Article 6(3). Competent authorities may authorise a development only if they can 'ascertain' that it will not adversely affect the integrity of the N2000 site concerned. The CJEU has favoured an inflexible application of the precautionary principle when interpreting the normative term of 'ascertain'. The CJEU held that, after having taken into account the conclusions of the AA, competent

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[57] Ibid
[58] Jonathan Verschuuren, 'Shellfish for Fishermen and for Birds? Article 6 Habitats Directive and the Precautionary Principle' (2005) 17 Journal of Environmental Law, 265, 281
[59] *Waddenzee*, Opinion of AG Sharpston, (n55), para. 48
[60] Jonathan Verschuuren, (2005), (n58), p.281
[61] Ibid.

licensing authorities may authorise a plan or project only if they have made certain that it will not adversely affect the integrity of the site.[62] According to the Court, 'that is the case where no reasonable scientific doubt remains as to the absence of such effects'.[63] With that said, the CJEU further added that where a doubt remains as to the absence of adverse effects on the integrity of the site, the competent authority will have to refuse authorisation.[64] In other words, licensing authorities shall refrain from granting development consents where reasonable scientific doubt remains as to the effects of ORE projects on the integrity of N2000 sites.

The CJEU justifies its position in light of the precautionary principle and performs a very light proportionality test according to which Article 6(3) integrates the precautionary principle and makes it possible to prevent, in effective manner, adverse effects to the integrity of N2000 sites. A less stringent authorisation criterion under Article 6(3) could not, according to the Court, ensure as effectively the fulfilment of the objective of site protection intended under that provision.[65] This jurisprudence has been consistently repeated in a number of subsequent decisions[66] including in the recent *Hilde Orléans*,[67] *People over Wind*[68] and *Grace and Sweetman*[69] cases (see further below). The CJEU further clarified the threshold of precision that the AA must meet for the purpose of Article 6(3). An assessment is not appropriate if 'it contains gaps and lacks complete, precise and definitive findings and conclusions capable of removing all

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[62] *Waddenzee*, (n46), paras.55-56
[63] Ibid, para.59
[64] Ibid, para.57
[65] *Waddenzee*, (n46), para.58
[66] Case C-441/17 *Commission v. Republic of Poland* [2018] ECLI:EU:C: 2018:255, para.120; Case C-399/14 *Grüne Kaga Sachsen ev and Others* [2016] ECLI:EU:C: 2016:10, para.50; Case C-404/09 *Commission v Spain* [2011] ECR I-11853, para 99; Case C-182/10 *Marie-Noël Solvay and Others* [2012] ECLI: EU:C: 2012:82, para. 67; Case C-304/05 *Commission v. Italy* [2007] ECR I-7519, para.58
[67] Joined Cases C-387/15 and 388/15 *Hilde Orleans and Others v. Vlaams Gewest* [2016] ECLI:EU:C: 2016:583, para.45
[68] Case C-323/17 *People Over Wind and Sweetman v. Coillte Teoranta* [2018] ECLI:EU:C: 2018:244, para.38
[69] Case C-164/17 *Grace and Sweetman v. An Bord Pleanála* [2018] ECLI:EU:C: 2018:593, paras.41, 51

reasonable scientific doubt as to the effects' of a project on the integrity of a site.[70] Further, to be lawfully conducted, an AA must identify, in the light of the best scientific knowledge in the field, all aspects of the development project which can, by itself or in combination with other plans or projects, affect the site's conservation objectives.[71] It cannot be held that an assessment is appropriate 'where information and reliable and updated data are lacking'.[72] It is therefore the developer's duty to ensure that their Natura Impact Statements[73] have no gaps and that the science relied upon is the best scientific knowledge in the field.[74] What is more, in a recent decision in *Moorburg*,[75] the CJEU reiterated its position in *Commission v. Portugal*[76] to note that it is at the time of decision-making that there must be no reasonable scientific doubt as to the absence of adverse effects on the integrity of the site in question.[77]

Interestingly, the CJEU has not defined the notion of 'reasonable scientific doubt'. From a common law perspective, this evidentiary burden appears to equate to the criminal standard of proof of 'beyond all reasonable doubt'.[78] In the common law system, the prosecution has the burden of proving the charge beyond reasonable doubt.[79] This is the highest standard of proof which can be contrasted with the lesser

[70] *Commission v. Italy*, (n66), para.69; Case C-418/04 *Commission v. Ireland* [2007] ECR I10947, para.100
[71] *Waddenzee,* (n46), para.54; *Commission v. Italy*, (n66), para.69 *Commission v. Spain*, (n66), para.99
[72] Case C-43/10 *Nomarchiaki Aftodioikisi Aitoloakarnanias and Others* [2012] ECLI:EU:C: 2012:560, apra.115
[73] Natura Impact Statements (NISs) are prepared by project developers to allow competent licensing authorities to undertake an appropriate assessment of the implication of the project for the conservation objective of the site concerned. NISs describe the project, identify and characterise any possible implications of the project, alone and in combination with other projects on the conservation objectives of the site.
[74] Arthur Cox, Legal update: Environmental and Planning Challenges for the Wind Energy Sector (Group Briefing, March 2015). <http://www.arthurcox.com/wp-content/uploads/2015/03/Legal-Update-Environmental-and-Planning-Challenges-for-the-Wind-Energy-Sector.pdf> (10 October 2016)
[75] Case C-142/16 *Commission v. Germany (Moorburg)* [2017] ECLI:EU:C: 2017:301
[76] Case C-239/04 *Commission v. Portugal* [2006] ECR I-10199, para.24
[77] *Moorburg*, (n75), para.42
[78] Charles George, 'Adverse effects in the Integrity of a European Site: Some Answered Questions' in Jones G., (ed.) *The Habitats Directive: A Developer's Obstacle Course?* (Hart Publishing, 2012), 151, 153
[79] Jack B. Weinstein and Ian Dewsbury, 'Comment on the meaning of 'proof beyond a reasonable doubt' (2006) 5 Law, probability and Risk, 167

civil standard of proof: the balance of probabilities. An often quoted case defines the burden of ‘beyond reasonable doubt’ as follows:

> ‘Proof beyond a reasonable doubt must be proof of such a convincing character that a reasonable person would not hesitate to rely and act upon it in the most important of his own affairs. The jury will remember that a defendant is never to be convicted on mere suspicion or conjecture’.[80]

Even more clearly, the Supreme Court of the United States favours a straightforward definition of ‘reasonable doubt’ whereby:

> ‘Proof beyond a reasonable doubt is a proof that leaves jurors firmly convinced of the defendant’s guilt. […]. If based on your consideration of the evidence, you are firmly convinced that the defendant is guilty you must find him guilty. If on the other hand, you think there is a real possibility that he is not guilty, you must give him the benefit of the doubt and find him not guilty’.[81]

It is therefore the prosecution’s responsibility to prove its case by more than a mere preponderance of the evidence. ORE developers embody the role of both the prosecution and defendant (who corresponds to the accused in a criminal law trial) in that they must prove their ‘innocence’ by providing sufficient evidence to convince licensing authorities beyond a reasonable doubt that their projects and associated ancillary works will not adversely impact upon the integrity of N2000 sites. If competent licensing authorities consider that ‘there is a real possibility’ that a project and its ancillary works will adversely affect the integrity of the site, development consent must be refused unless the project is found to be necessary for an imperative and overriding reason of public interest within the meaning of Article 6(4).

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[80] *United States v. Savulj*, 700 F. 2d 51, 69 (2nd Cir, 1983)
[81] *Victor v. Nebraska*, 511 U.S. 1, 27, 114 S. Ct. 1239, 1253 (1994)

The Court has not had the opportunity to confirm its jurisprudence in cases involving permissions for ORE developments. In two recent judgements, the CJEU has nonetheless confirmed that the strict precautionary standards of Article 6(3) similarly apply with respect to the authorisation of two Irish terrestrial wind farms. Even though the factual backgrounds differ, both cases arose from a reference for preliminary ruling submitted to the CJEU by the Irish High Court and the Irish Supreme Court. In essence, in *People over Wind*,[82] the CJEU had to decide whether mitigation measures could be taken into consideration at the screening stage to determine whether an AA was necessary with respect to ancillary cable works connecting the wind farm to the electricity grid. The Court repeated its seminal case law whereby Article 6(3) 'integrates the precautionary principle and makes it possible to effectively prevent adverse effects on the integrity of N2000 sites; a less stringent criterion of authorisation could not ensure as effectively the objective of site protection'.[83] In light of this established jurisprudence, the CJEU has considered that it is not appropriate to take into account mitigation measures at the screening stage as this would deprive the 'integrity test' of the AA process of its purpose and create a risk of circumvention of that stage,[84] which constitutes an essential safeguard of the 'effet utile' of the Habitats Directive.[85] *People over Wind* is an important departure from an established practice in Ireland whereby mitigation measures could be considered at the screening stage.[86] This ruling will now make it significantly harder, if not impossible, to screen out the need for a full AA, including towards renewable energy projects. Stated differently, many more renewable

[82] *People Over Wind and Sweetman*, (n68)
[83] Case C-127/02 *Waddenzee*, (n46), para.58; *Moorburg*, (n75), para.40; *Hilde Orleans*, (n68), para.53
[84] *People Over Wind and Sweetman*, paras.37-40
[85] Ibid, para.37
[86] *Ratheniska Timahoe and Spink (RTS) Substation Action Group v An Bord Pleanála* [2015] IEHC 18; *Hart District, R (on the application of) v Secretary of State for Communities and Local Government* [2008] EWHC 1204 (Admin)

energy developments will have to satisfy the evidentiary burden of 'no reasonable scientific doubt' to be granted development consents.

A similar ruling was upheld in *Grace and Sweetman,*[87] to reject the legality of a Species and Habitats Management Plan elaborated with a view to reconciling a wind energy development with the conservation objectives adopted for the hen harrier in a SPA. The factual background of this case will be discussed in further details in the first section of Chapter VII when analysing the legal feasibility of adaptive management. In a nutshell, the CJEU held that the positive effects of the habitat creation/restoration measures envisaged in the management plan to address the adverse impacts of the wind farm on the habitat of the hen harrier were highly difficult to forecast with any degree of certainty.[88] In so doing, the Court applied the reasoning of its landmark decision in *Briels*[89] to consider that habitat creation or restoration measures are compensatory by nature and hence, cannot be taken into account for the purpose of the AA process of Article 6(3).[90] Here again, the decision is firmly entrenched in the precautionary principle.[91] Based on the precautionary principle, the AA shall not leave any reasonable scientific doubt as to the absence of adverse effect of the proposed works on the integrity of the site concerned.[92]

These judgements are important further steps in the concretisation of the precautionary principle of Article 6(3) in the context of renewable energy developments. First of all, renewable energy projects cannot avoid the need for a full AA by taking mitigation measures into account for the purpose of screening the need for an AA. Second, in the

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[87] Case C-164/17 *Grace and Peter Sweetman v. An Bord Pleanála* [2018] ECLI:EU:C: 2018:593
[88] Ibid, para.52
[89] Case C-521/12 *TC Briels and Others v. Minister van Infrastructuur en Milieu* [2014] ECLI:EU:C: 2014:330
[90] *Grace and Sweetman,* (n87), paras.50, 57
[91] Ibid, para.54
[92] Ibid, para.51

face of remaining uncertainty, it is not possible to soften the standard of no reasonable scientific doubt by taking into account biodiversity conservation measures to establish the absence of a threat to the integrity of the site under the scope of the AA.

As a matter of course, these cases are not the first cases involving a clash between the promotion of wind energy and the protection of habitats and species.[93] For example, in *Azienda Agro-Zootenica Franchini Sarl*, the CJEU took the view that the Habitats Directive does not preclude more stringent legislation which prohibits in absolute terms the installation of all wind projects not intended for self-consumption on sites forming part of the N2000 network.[94] In the recent *Schwarze Sum River* case,[95] the CJEU opted for a more balanced approach when considering that, because of its contribution to environmental protection and sustainable development, the production of renewable energy from a hydro-electric plant can constitute an overriding public interest justifying derogation under the Water Framework Directive (WFD).[96] Although a similar jurisprudence would surely be welcomed in the context of the Habitats Directive, the author will argue later on in a detailed analysis of the proportionate character of the CJEU jurisprudence,[97] that *Schwarze Sum River* cannot be interpreted as a general rule.

[93] Case C-2/10 *Azienda Agro-Zootenica Franchini Sarl* [2011] ECR I-I-6561; Case C-141/14 *Commission v. Bulgaria* [2016] EU:C: 2016:8
[94] *Azienda Agro-Zootenica Franchini Sarl,* paras.56, 57
[95] Case C-346/14 *European Commission v. Republic of Austria* (*Schwarze Sulm River)* [2016] ECLI:EU:C: 2016:322, paras. 69-71
[96] Directive 2000/60/EC establishing a framework for the Community action in the field of water policy (WFD) [2000] O.J. L. 327/1
[97] Chapter V, section 6.2

3 - The judicial interpretation of 'ecological integrity': a catalyst for precaution in the face of uncertain impacts on Natura 2000 sites

3.1 The purposive approach to interpretation of the notion of 'ecological integrity'

As discussed above, the granting of licences is conditional upon the findings of the AA meeting the legal test of no reasonable scientific doubt. Remarkably the concept of ecological integrity remained undefined under the Habitats Directive until the *Sweetman* decision.[98] In the *Sweetman* case, the CJEU gave an important doctrinal role to the precautionary principle to interpret the notion of 'integrity of the site'.[99] According to the CJEU, a project adversely affects the integrity of the site:

> 'If it is liable to prevent the lasting preservation of constitutive characteristics of the site that are connected to the presence of a priority natural habitat type whose preservation was the objective justifying the designation [of that site]. The precautionary principle should apply for the purpose of that appraisal.[100]

The CJEU justified its reasoning in the light of the precautionary principle:[101]

> It is to be noted, that since the authority must refuse to authorise the plan or project where uncertainty remains as to the absence of adverse effects on the integrity of the site, the authorisation criterion laid down in the second sentence of Article 6(3) of the Habitats Directive integrates the precautionary principle and makes it possible to prevent in an effective manner adverse effects on the

[98] Case C-258/11 *Sweetman and others v. An Bord Pleanála (Sweetman)* [2013] ECLI:EU:C: 2013:220
[99] Owen McIntyre, John O'Halloran, 'The gulf between legal and scientific conceptions of ecological 'integrity' in Byrne E., Mullally G., Sage C. (eds), *Transdisciplinary Perspectives on Transitions to Sustainability* (1st edn, Routledge, 2017), 131, 134
[100] *Sweetman*, (n98), para.48
[101] Ibid, para.41

> integrity of protected sites as a result of the plans or projects being considered. A less stringent authorisation criterion than that in question could not ensure as effectively the fulfilment of the objective of the site protection intended under that provision. Such an appraisal applies all the more in the main proceedings, since the habitat affected by the proposed road scheme is among the priority natural habitat types [...]. The competent national authorities cannot therefore authorise interventions where there is a risk of lasting harm to the ecological characteristics of sites which host priority natural habitat types'.[102]

The judgement in the *Sweetman* case is remarkable. The purposive method of legal interpretation provides a clear-cut example of how the doctrinal role of the precautionary principle is being used by the Court to deal with uncertain direct and indirect impact in the AA process (section 3.3 below). In *Sweetman*, CJEU unequivocally considered that the permanent loss of 1.47 hectares of a priority habitat under Annex I of the Habitats Directive in the vicinity of the total 270-hectare area of such priority type habitat constitutes an adverse impact on the integrity of this site. In so doing, the CJEU relied on the doctrinal function of the precautionary principle to inform a purposive interpretation of 'adverse effects on the integrity of the site' under Article 6(3).[103] The central goal of this approach is to achieve the aims of environmental directives by interpreting the meaning of their normative terms.[104] As discussed in Chapter III, the precautionary principle has been used doctrinally under a number of environmental Directives to interpret the meaning of legal terms[105] such as 'wastes',[106]

[102] *Sweetman*, (n98), paras. 41-43
[103] Owen McIntyre and John O'Halloran, (2017), (n99), at 131
[104] Emma Lees, *Interpreting Environmental Offences: The Need for Certainty* (1st edn, Hart Publishing, 2015), 104
[105] Eloise Scotford, *Environmental Principle and the Evolution of Environmental Law* (1st edn, Hart Publishing, 2017), 149
[106] Case C-9/00 *Palin Granit Oy and Vehmassalon Kansanterveystyön kuntayhtymän hallitus* [2002] ECR I-3533, paras.23-24

‘discarding’[107] or ‘plans or projects’.[108] A first statement on the purposive approach to interpretation has been given in *Palin Granit* in which the EU Court allows an expansive interpretation of the term ‘waste’ under the Waste Framework Directive. After arguing that the term ‘waste’ turns on the meaning of the term ‘discard’, the CJEU held that:

> ‘The term 'discard' must be interpreted in light of the aim of Directive 75/442 which, according to its third recital, is the protection of human health and the environment against harmful effects caused by the collection, transport, treatment, storage and tipping of waste, and Article 174(2) EC, which provides that Community policy on the environment is to aim at a high level of protection and is to be based, in particular, on the precautionary principle and the principle that preventive action should be taken. It follows that the concept of waste cannot be interpreted restrictively […]. The question whether a given substance is waste must be determined in light of all the circumstances, regard being had to the aim of Directive 75/442 and the need to ensure that its effectiveness is not undermined’.[109]

The purposive approach of *Palin Granit* has been consistently reiterated by the Court including in the *Waddenzee* case for the purpose of screening with respect to interpreting the meaning of ‘likely significant effect’ on the site.[110] Commenting on the genesis of this method in the earliest case law,[111] Judge Schockweiler argued that: ‘this

[107] Case C-1/03 *Van De Walle v. Texaco Belgium SA* [2004] ECR I-7613, para.45
[108] Joined Cases C-419/97 and C-419/97 *ARCO Chemie Nederland Ltd* [2000] ECR I-4512, paras. 37-40
[109] Case C-9/00 *Palin Granit*, (n106), paras.23-24
[110] *Waddenzee*, para.43, 44
[111] Case C-26/62 *Van Gend En Loos v. Nederlandse Administratie der Belastingen* [1963] ECLI:EU:C: 1963:1. The Court enunciated the essence of the method: ‘it is necessary to consider the spirit, the general scheme and the wording" of the provision in question’; in Case C-6/72 *Europemballage Corp. & Continental Can Co. v. Commission* [1973] ECLI:EU:C:1973:22, para. 22 : the CJEU held that interpretation of the meaning of the word ‘abuse’ under Article 86 of EEC Treaty had to consider ‘the spirit, general scheme and wording of Article 86, as well as to the system and objectives of the Treaty’; in Case C-803/79 *Criminal Proceedings against Gérard Roudolff* [1980] ECLI: EU:C:1980:166: the CJEU

[purposive] interpretation allows a development beyond the literal meaning of the text in a dynamic direction in the light of the purpose pursued by the Treaty in its entirety and in its context'.[112] The rationale behind the purposive interpretation technique is to ensure the 'effet utile' of environmental directives by interpreting their provisions in the light of their objectives.[113] In a similar vein, the doctrine of effectiveness or 'effet utile' is described by Judge Fennelly as the 'constant companion' of the purposive method of the Court. This doctrine provides that 'once the purpose of a provision is clearly identified, its detailed terms will be interpreted in the light of this purpose in order 'to ensure that the provision retains its effectiveness'.[114] Both the doctrine of effectiveness and its corollary, the purposive method of interpretation, 'lead the Court to seek above all effectiveness, consistency, and uniformity in the application of Community law'.[115]

In both *Sweetman* and *Briels,* the CJEU held that the Habitats Directive must be construed as a coherent whole in light of the conservation objectives pursued by the Directive.[116] In the *Sweetman* case, the CJEU has interpreted the notion of 'integrity of the site' in light of overall objectives pursued by the Habitats Directive – which is to maintain or restore at a favourable conservation status the natural habitats and species of Community Interest.[117] In *Sweetman*, the priority natural habitat type of European interest was the limestone pavement. The conservation objectives of the eligible extension of the Lough Corrib SAC were to maintain the limestone pavement at a favourable conservation status. Following the reasoning of AG Sharpston, the Court

emphasised the ambiguity of a French provision to rule that 'the function of the words in question must be examined in the light of the intention and purpose of the regulation in question' (*Criminal Proceedings against Gérard Roudolff* , para.7).

112 Schockweiler F., 'La Cour de justice des Communautés européennes dépasse-t-elle les limites de ses attributions ?' (1995) 18 Journal des Tribunaux, Droit Européen, 73

113 Nial Fennelly, 'Legal Interpretation at the European Court of Justice' (1996) 20 (3) Fordham International Law Journal, 656

114 Ibid, p.674

115 Ibid

116 *Sweetman*, (n98), para.32; Case C-521/12 *TC Briels and Others,* (n89), para.19

117 Habitats Directive, Article 2 (1), (2)

came to the conclusion that the loss of a small portion of limestone pavement (1.47ha out of 270 ha) amounts to an adverse impact on the integrity of the site itself. Competent authorities cannot authorise an intervention where there is a risk that such intervention will bring about disappearance or the partial and irreparable destruction of a priority natural habitats type even if this would affect only 1,5 % of total habitat type protected by the site concerned. In other words, the CJEU has restricted the notion of 'integrity' to that of 'conservation objectives' of the qualifying interest of the site, i.e. the limestone pavement.[118] In 2017, McIntyre and O'Halloran argued in their writings that the question of whether similar reasoning would be applied to a non-priority habitat type or species was not clearly specified.[119] The recent Commission notice on Article 6 has unequivocally confirmed that the logic behind the judicial interpretation of 'site integrity' in *Sweetman* is also relevant with respect to non-priority habitat types and to habitats of species.[120]

Paradoxically, although the CJEU establishes a holistic requirement to consider the ecological characteristics that are connected to the presence of a N2000 qualifying feature, the Court also endorses a restrictive approach to the integrity standard by holding that the loss of a limited portion of limestone pavement constitutes an adverse impact on the ecological integrity of the site, hence, leaving no leeway for a *de minimis* exemption under Article 6(3). Typically, a *de minimis* exception would allow competent authorities to permit projects which despite the existence of a localised impacts on a N2000 site or its qualifying features would not compromise the entire ecological integrity of the site itself, and as such the capacity of the site to meet its conservation

[118] McIntyre and O'Halloran, (2017), (n99), at 131
[119] Ibid, 132
[120] European Commission, 'Managing Natura 2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC' (Commission notice) C (2018) 7621 final, p.49

objectives (see section 3.2 below). This was the interpretation taken by the Irish High Court in *Sweetman*:

> Read with the three words ["the integrity of"] in question deleted, the Article would offer protection that was comprehensive, unqualified and unconditional. If there was any desire to extend the protection that the Directive would afford, and it is hard to see why there would be given that the protection is entirely comprehensive, that could be achieved with much greater clarity by inserting words such as "whether direct or indirect" after the word "thereon", so that the requirement for an appropriate assessment would be stated to apply to all plans or projects likely to have a significant effect on a site, whether directly or indirectly.[121]

In so doing, the CJEU has narrowed down the scope of the integrity assessment to a strict analysis of the sites' conservation objectives, ignoring the scientific understanding of 'ecological integrity'.[122] More shockingly, the CJEU has paid no attention to the methodological guidance of the EC (see below). It will be argued later that such an understanding of ecological integrity may have far-reaching implications in terms of burden of proof required from developers to inform an AA.

[121] *Peter Sweetman v. An Bord Pleanála* [2009] IEHC 599, para.64
[122] Owen McIntyre, 'The appropriate assessment process and the concept of ecological 'integrity' in EU nature conservation law' (2013) 21(6) Environmental Liability, 203

3.2. 'Ecological integrity' in the scientific discourse

The reasoning of the CJEU seems to be in contradiction with the EU methodological guidance of the EC[123] and scientific understanding of ecological integrity. The EC guidance documents endorse an ecosystem understanding of the notion of 'integrity of the site' under the Habitats Directive. Pursuant to the EC guidance 'Managing Natura 2000 sites', the meaning of 'integrity of the site' can be considered as a 'quality of being whole or complete'.[124] In a dynamic ecological context, it can be considered as having a 'sense of resilience and the ability to evolve in ways that are favourable to conservation of its qualifying features'.[125] The same guidance indicates that the 'integrity of the site' refers to the 'coherence of the site's ecological structure and function, across its whole area, or the habitats, complex of habitats and/ or population of species for which the site has been classified'.[126] A site can be described as having a high degree of integrity where the inherent potential for meeting site conservation objectives is realised, the capacity for self-repair and self-renewal under dynamic conditions is maintained.[127] In the methodological guidance on Articles 6(3) and (4), the EC provides the 'integrity of site checklist' to assist developers with determining whether a project will adversely affect the integrity of a site.[128] Assessing potential effects on the integrity of a N2000 site involves a holistic determination of whether the project will disrupt those factors that help to maintain the favourable conditions of the site, interfere with the balance, distribution and density of key species that are the indicators of the favourable condition of the site. In this respect, the checklist of the integrity test requires other 'ecosystem'

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[123] European Commission, 'Assessment of Plans and projects significantly affecting Natura 2000 sites: Methodological Guidance on the Provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC. (November 2001). <http://ec.europa.eu/environment/nature/natura2000/management/guidance_en.htm> (accessed 20 March 2016)
[124] European Commission, 'Managing Natura 2000 sites', (n120), at 49
[125] Ibid.
[126] Ibid.
[127] Ibid.
[128] European Commission, (n123), at 28-29

considerations including the question of whether a project will change the vital defining aspects (e.g. nutrient balance) that determine how the site functions as a habitat or ecosystem, or change the dynamics of the relationships (between, for example, soil and water or plants and animals) that define the structure and/or function of the site.[129] The connotation of 'integrity' under EC guidance documents clearly relates to the concept 'ecological integrity' as defined in the field of ecology.[130] A plethora of statements exist on what constitute 'ecological integrity'.[131] 'Ecological integrity' has been defined as a 'proxy' to measure the capacity of a natural ecosystem to support biological diversity.[132] In a similar thought, Wurtzebach and Schultz clarify that ecological integrity emphasises the importance of ecological processes, such as natural disturbances regimes, that provide the structures and functions on which the full complement of species in an ecosystem depend.[133] An ecological system has integrity if its 'dominant ecological characteristics', namely species composition, structure and functional organisation, 'occur within their natural range of variations and can withstand and recover from most perturbations imposed by natural environmental dynamics and human perturbations'.[134] Adapting the definition of Karr and Dudley,[135] the Millennium Ecosystem Assessment similarly acknowledges that ecological integrity refers to the 'the ability of an ecological system to support and maintain a community of organisms that has species composition, diversity, and functional organization comparable to those of natural habitats within a region'.[136] An 'integrity assessment' is commonly defined in

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[129] Ibid, 29

[130] European Commission, (n120), at 49

[131] Eleanor Brown, Byron K. William, 'Ecological integrity assessment as a metric of biodiversity: are we measuring what we say we are? (2016) 25 Biodiversity Conservation, 1011

[132] Jeffrey D. Parrish, David P. Braun, Robert S. Unnasch, 'Are we conserving what we say we are? Measuring ecological integrity within protected areas' (2003) 53 Bioscience, 851, 852

[133] Zachary Wurtzebach and Courtney Schultz, 'Measuring Ecological Integrity: History, Practical Applications, and Research Opportunities' (2016) 66 BioScience, 446

[134] Parrish and others, (2003), Op. cit, (132), 852

[135] James R. Karr and Daniel R. Dudley, 'Ecological perspective on water quality goals' (1981) 5 Environmental Management, 55

[136] Millennium Ecosystem Assessment, *Ecosystems and Human Well-Being: A Framework for Assessment* (Island Press, 2003), 70

ecology as a measure of ecosystems' conditions that represent their 'structure, function, species composition, diversity and functional organization'.[137] In line with the scientific definition, the integrity of N2000 sites must be intimately associated with the maintenance of ecological processes and functions that sustain the conservation of the site's designated features.[138] The integrity of the site, and as such its capacity to achieve its conservation objectives, would therefore be dependent upon securing the ecological functions and structures of the site as a whole.

The notion of 'integrity of the site' is not defined by the Habitats Directive. This is highly surprising in that this is precisely the condition that the AA process of Article 6(3) purports to protect from harmful activities. The legal definition of 'integrity of the site' under the Habitats Directive can be derived from that of conservation status. As noted above, the overarching requirement of the Habitats Directive is to achieve 'favourable conservation status' (hereafter: FCS) of Annex I habitat types and Annex II species.[139] Conservation objectives of N2000 sites are specified objectives to be met within the site in order for it to make a meaningful contribution to achieving the objective of FCS of natural habitats or species for which the site has been designated. The Habitats Directive defines 'conservation status' as the 'sum of influences' acting on a natural habitat and its typical species that may affect its long-term natural distribution, structure and functions as well as the long-term survival of its typical species within the territory referred to in Article 2.[140] With respect to species, conservation status means the 'sum of the influences' acting on the species concerned that may affect the long-term distribution and abundance of its population within the territory referred to in

[137] Brown and William, (n131), 1013
[138] Sian Rees and others, 'A legal and ecological perspective of "site integrity" to inform policy and management of Special Areas of Conservation in Europe' (2013) 72 Marine Pollution Bulletin, 14, 19
[139] Habitats Directives, Article 2, Article 3(1), Article 4(4)
[140] Habitats Directive, Article 1 (e)

Article 2.[141] The 'territory' referred to in Article 2 corresponds to N2000 sites. The Habitats Directive defines 'sites' as 'geographically defined areas whose extent is clearly delineated'.[142] In other words, the integrity of a N2000 site seems to be informed by the 'sum of the influences' within this site that ensure important ecological functions and processes sustaining the conservation status of species or habitats types. The wholeness of a site's ecosystem should therefore be considered in the regime of Article 6(3).[143] From this textual analysis of Article 1 (e) and (i), the integrity test of Article 6(3) would involve a holistic, ecosystem-based determination of whether the effects on a N2000 site of a proposed undertaking, including ORE projects, are such that these will disrupt those ecological factors within the site that help maintain the favourable conservation conditions of the species and habitats for which the site has been designated.

As a matter of course, conservation objectives are highly relevant to determine whether an adverse effect on the integrity of N2000 sites will occur. The 'integrity test' of Article 6(3) should be understood as a determination of whether the identified significant effects on the site's conservation objectives of are such that these will encroach on the integrity of the site,[144] understood as the ability of the site to evolve in ways that are favourable to conservation of its qualifying features'.[145] A proposed ORE development must be considered as adversely affecting the integrity of a N2000 site only if its implementation would undermine the site's capacity to sustain key ecosystem functions

[141] Habitats Directive, Article 1(i)
[142] Habitats Directive, Article 1(j)
[143] Broekmeyer M.E.A., Bastmeijer C.J., Kamphorst D.A., (2017). Towards an improved implementation of the Birds and Habitats Directive; An inventory of experiences in Austria, England, Flanders and the Netherlands in relation to two dilemma's. (Wageningen, Wageningen Environmental Research, Report 2833). 86pp. <https://library.wur.nl/WebQuery/wurpubs/528776> (accessed 14 July 2018), at 29-30
[144] Charles George, 'Adverse effects in the Integrity of a European Site', (n78), 155-158
[145] European Commission, (2018), (n120), 49

that are critical to restore/maintain the conservation status of its key natural habitat type or species.

Other commentators have confirmed this point. Analysing the notion of ‘site integrity’ from both an ecological and legal perspective, Rees *et al*, point out that ‘assessing the integrity of N2000 sites requires the complex task if understanding the ecosystem organisation at a location in terms of ecosystem structure, functions and connectivity with qualifying features’.[146] The achievement of sites’ conservation objectives and of the overarching objective of FCS would be dependent upon securing these ecosystem functions and processes.[147] Rees *et al*, conclude that it is therefore important for both ecological and legal purposes ‘to treat the site as a whole’ and not the to focus merely on its individual feature or limited portion of habitats within the site.[148] Interestingly, the CJEU took a different view. The jurisprudence of the CJEU in *Sweetman* seems to refrain from considering the integrity of ‘site’ as a whole and restricts the notion of ecological integrity of the site to a limited examination of the effect on the integrity of a portion of habitat within the site.

To comply with the judicial principles of the CJEU, domestic courts endorse a similar approach to interpretation, sometimes restricting the integrity test to a strict analysis of N2000 sites’ conservation objectives. By way of an example, the purposive approach of the Court can be seen, quite strikingly, in *RSPB v Secretary of State for Environment, Food and Rural Affairs* [2015].[149] In this case, the Royal Society for the Protection of Birds (RSPB) was seeking judicial review of the dismissal of its claim against the Secretary of State’s decision to direct Natural England to cull two species of gulls

[146] Rees and others, (n138), 19
[147] Ibid.
[148] Ibid.
[149] *RSPB v. Secretary of State for Environment, Food and Rural Affairs* [2015] EWCA Civ. 227

within a SPA. Judge Mitting departed from the purposive approach of the CJEU in ruling that the focus of the integrity test must be on the effect on the ecological integrity of the site and not on the conservation objectives behind its designation.[150] Under the 2011 conservation objectives adopted for the SPA, if natural fluctuations were known, the objective was to maintain the population at or above the minimum for the site. Where natural fluctuations were unknown, to maintain or restore the population above 75 % of that at designation; a loss of 25% or more is unacceptable. On this basis, the Secretary of State decided that the reduction of the number of gulls to a figure which maintained the population to a number which was above 75% of its baseline would not result in the population of gulls being in an unfavourable status.[151] Mitting J. concluded that the Secretary of State made a careful and rational assessment of those numbers which could be safely culled before the long-term viability of the lesser-black gull was impaired.[152] Mitting J. further reasoned that what might lead to the decline of gulls was the decrease of their habitats and a cutting off or reduction of food. Because the cull would not, except temporarily, affect the habitat of the gulls, the integrity of the site would not be affected by it.[153] The Court of Appeal quashed the decision and came back to a strict analysis of the conservation objectives. The Court held that the Secretary of State misinterpreted the conservation objectives and wrongly used a generic threshold (25%), which only allows for natural fluctuation in the bird populations in the SPA, to justify deliberate reduction of populations to, and thereafter maintaining them at, a percentage (above 75%) of the population at designation. In the absence of a known

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[150] Colin T. Reid, 'Balancing nature and renewable energy' (2014) 26(4) Environmental Law and Management, 100

[151] *RSPB v. Secretary of State for Environment, Food and Rural Affairs* [2015] EWCA Civ. 227, para.77, 82

[152] *RSPB v. Secretary of State for Environment, Food and Rural Affairs* [2014] EWHC 1645, para.42

[153] Ibid.

minimum figure, the threshold of 75% is simply a proxy for the bottom end of their natural range.[154]

In a nutshell, although the *Sweetman* conclusions establish a holistic requirement to consider the ecological characteristics of N2000 sites, this emphasis on the ecosystem approach contrasts with the restrictive understanding of 'ecological integrity' taken by the CJEU. According to the CJEU, a small direct impact on N2000 qualifying features constitutes an adverse effect on the integrity of the site even if the site's inherent ecological integrity and as such, its capacity to meet conservation objectives, is not, *per se* undermined. Paunio reasons that in the context of EU law, where 'multilingualism reduces the appropriateness of linguistic reasoning, a highly purposive approach, by increasing substantive certainty, will increase legal certainty as a whole'.[155] The CJEU may 'bend or ignore the literal meaning'[156] of "ecological integrity" to prevent divergent interpretations of this complex scientific notion in order to ensure the effectiveness of the protection scheme of the Habitats Directive. Beyond these linguistic concerns, the purposive method of interpretation taken by the judiciary strikingly illustrates a significant disconnection between environmental law and ecological science, and more particularly, between how these connected disciplines approach scientific uncertainty.

[154] *RSPB v. Secretary of State* [2015] EWCA Civ. 227, paras.23, 24, 25, 31

[155] Elina Paunio, Legal Certainty in Multilingual EU Law: Language, Discourse and Reasoning at the European Court of Justice (Farnham, Ashgate Publishing 2013), 52-53

[156] Fennelly, (1996), (n113), 674

3.3. A catalyst for precaution in the face of uncertain direct and indirect impacts on Natura 2000 qualifying features

McIntyre notes that the CJEU expressly links the application of the precautionary principle with situations 'where uncertainty remains as to the absence of adverse effects on the integrity of the site'.[157] In *Sweetman*, the highly purposive method of interpretation taken by the CJEU in relation to the term of 'site integrity' epitomises the guidance function of the precautionary principle. In particular, this 'effectiveness-dominated', which Lees also refers to as 'certainty-focused',[158] approach to interpretation, provides a striking example of how the doctrinal role of the precautionary principle is being used by the judiciary to deal with uncertain direct and indirect ecological impacts in the AA process.

The Court clearly endorses a restrictive approach to the notion of 'ecological integrity' by considering that the permanent loss of a small portion of a priority habitat (1.5% of the total surface of such priority type habitat) constitutes an adverse impact on the integrity of a N2000 site, hence, leaving no leeway for a *de minimis* exemption under Article 6(3). In the specific context of the *Sweetman* case, there was no certainty that the loss of 1.47 hectares of limestone pavement (direct impact) would not have an adverse impact on the long-term structure and functioning of the site and thus, the conservation status of the limestone pavement. By considering that a loss or damage caused to any portion of priority natural habitat constitutes an adverse impact on the integrity of the site itself, the CJEU clearly regards the purposive approach as a legal interpretation technique capable of informing substantive protection in the face of uncertainty. In the *Sweetman* context, the exclusion of a *de minimis* exemption under

[157] Owen McIntyre, 'EU legal protection for ecologically significant ground water in the context of climate change vulnerability' (2017) 42 (6) Water International, 709

[158] Lees, '*Interpreting Environmental Offences*', (n104), 179

Article 6(3) will ensure that no unexpected adverse effects to the integrity of N2000 sites will occur as a result of the 'ripple effect' of localised minor incursions. The 'precautionary function' associated with the purposive approach has been largely endorsed by AG Sharpston as a legal interpretation method that prevents 'the death by a thousand cuts' phenomenon, that is to say, cumulative habitat loss as a result of multiple, or at least a number of, lower level projects being allowed to proceed on the same site'.[159]

Paradoxically, the CJEU also establishes a holistic requirement to consider the constitutive characteristics of N2000 sites 'that are connected to the presence'[160] of a N2000 qualifying feature. The applicants in the main proceedings before the Irish High Court in the *Sweetman* case[161] argued that the integrity assessment of Article 6(3) 'was designed to deal with the situation where an effect on the site, although not a direct one, might nevertheless undermine the integrity of the site'.[162] This would the case in situations where upstream activity might have an adverse impact on water quality or qualifying habitats and species situated downstream.[163] Without permitting a *de minimis* exception, the reference made by the CJEU to 'the characteristics of the site' indicates that the Court may have envisaged all situations where a project may have an indirect adverse effect on the sites or its qualifying habitats or species because of affecting other relevant ecosystem processes or functions that are important to sustain the conservation status of the habitat types or species of interest. In *Bund Naturschutz in Bayern,*[164] the CJEU has shed some light on the notion of 'characteristics of the site' when deciding on the type of 'appropriate' protective measures to be adopted by Member States in respect

[159] *Sweetman*, Opinion AG Sharpston, 22 November 2012, para 67
[160] *Sweetman*, (n98), para. 48
[161] *Peter Sweetman v. An Bord Pleanála* [2009] IEHC 599
[162] Ibid, para.61
[163] Ibid.
[164] Case C-244/05 *Bund Naturschutz in Bayern eV. and others v. Freistaat Bayern* [2006] ECR I-8445

of proposed Sites of Community Interest (SCIs). The CJEU opts for a broad understanding of the notion of 'characteristics of the site' to include other ecological features which are not *per se* the habitat types or species for which the site has been designated but contribute to the conservation of these qualifying habitats and species. The Court held that the characteristics of the site 'must reflect a number of factors including the degree of representativity of the habitat type, its structure and functions, the feature of the habitats which are important for the species concerned and the value of the site for the conservation of the habitat or species'.[165] While this clarification was made with respect to appropriate protection measures for proposed SCIs, there is no reason why the reasoning of the Court would be different once the site has been included in the list of SCIs. The approach of the Court is consistent with the 'integrity of site checklist' of the EC methodological guidance.[166] As discussed above, the 'integrity of the site checklist' highlights that the integrity test requires taking into account broader 'ecosystem' considerations to assess the effects of a project on other ecological factors such as: 1) 'any vital defining aspects (e.g. nutrient balance) that determine how the site functions as a habitat or ecosystem'; 2) 'dynamics of relationships between, for example, soil and water or plants and animals that define the structure and/or function of the site', 3) water dynamics or chemical composition. Such an emphasis on the ecosystem approach indicates that natural values which make the site suitable for the conservation of qualifying species or habitats must be equally be considered in the integrity test of the Article 6(3) regime.[167]

Rees and others follow the same line of reasoning when arguing that the legal definition of 'site integrity' must be understood as including the maintenance of ecological processes and functions that sustain the conservation status of a qualifying marine

[165] Ibid, para.46
[166] European Commission, 'Methodological Guidance', (n123), at 28-29
[167] Broekmeyer and others, (2017), (n143), 29

habitats or species.[168] To determine whether the integrity of the site will be affected by an ORE project, 'the essential question the decision-maker must ask is 'why was this particular site designated and what are its conservation objectives?'.[169]

The fundamental issue here is that scientific knowledge usually lags far behind what is required by law to inform regulatory decision-makers.[170] This is particularly the case in relation to measuring the complex interactions between ecosystem processes and functions in relation to conservation status of N2000 features.[171] In this connection, the CJEU may therefore have created an additional level of protection to ensure that no indirect adverse impacts will occur because of insufficient scientific understanding of ecosystem connectivity. As such, the judicial interpretation of 'integrity of the site' seems to infer that the legal test of no reasonable scientific doubt must equally be satisfied with respect to any direct or indirect impacts likely to occur by connectivity with natural habitat types or species of N2000 sites. This has been confirmed quite clearly in the very recent *Moorburg* case.[172] The CJEU found that the project being challenged was not located in the N2000 areas concerned but rather at a considerable distance from them (600km upstream), but that this in no way precludes the applicability of the requirements of Article 6(3) of the Habitats Directive.[173] The CJEU rejected the argument of the German authorities whereby it is 'almost impossible to determine with certainty all the likely effects of specific measures on N2000 areas over large geographical distances'.[174] Although this case concerned the installation of a coal-

[168] Rees and others, (n138), 19
[169] *Sweetman*, Opinion AG Sharpston, 22 November 2012, paras.55-56
[170] Jonathan W. Moore and others, 'Towards linking environmental law and science' (2018) 3 FACETS, 373
[171] Rees and others, (n138), 19
[172] Case C-142/16 *Commission v. Germany (Moorburg)* [2017] ECLI:EU:C: 2017:301
[173] Ibid, para.29
[174] Ibid, para.21

fired power plant, similar reasoning may be applied to offshore renewable energy plants.

Overall, the purposive approach to interpretation, reminiscent of the precautionary principle, clearly emphasises the fundamental differences between how law and environmental sciences approach scientific uncertainty. In Chapter III, the author has stressed that this dichotomy is particularly noticeable in the field of environmental law where the need for legal certainty must account for unpredictable ecological systems. Environmental law is characterised by a 'heavy reliance on science'.[175] In fact, as observed by De Sadeleer, 'science is the lynchpin around which environmental law is organised'.[176] 'This marriage is not entirely free of strife: while the jurist seeks certainty, the scientist points out to the uncertainty inherent to ecological risk'.[177] In environmental sciences, 'uncertainty [typically] provides a catalyst for exploration, whereas uncertainty is antithetical to the rule of law'.[178] Latour also writes that 'science can tolerate gaps but the law has to be seamless'.[179] As such, 'lawyers often view uncertainty as a barrier to enforceability and action'.[180] The underlying rationale behind the reliance on the purposive method is unquestionably to ensure the 'effet utile' of the site protection scheme of Article 6 in the face of uncertain direct and indirect impacts on N2000 features by imposing a very high scrutiny on new proposed developments. At this stage, the important question arises as to how realistic the judicial interpretation of Article 6(3) of the Habitats Directive is in the particular context of offshore renewable energy. More precisely, what are the legal consequences associated with the

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175 Nicolas De Sadeleer, 'The Precautionary Principle in EC Health and Environmental Law' (2006) 12(2) European Union Law, 139, 144
176 Ibid.
177 Ibid.
178 Olivia O. Green and others, 'Barriers and bridges to the integration of socio-ecological resilience and law' (2015) 13 (6) Frontiers in Ecology and the Environment, 332
179 Bruno Latour, *The Making of Law: An Ethnography of the Conseil d'Etat* (Cambridge, Policy Press, 2010), 243
180 Green and others, (n178), 332

interpretation of ‘integrity of the site’ in terms of standard of proof required from ORE developers?

4- Precautionary and purposive interpretation of ‘integrity of the site’: an unrealistic standard proof for offshore renewable energy developers

The jurisprudence of the CJEU, and more particularly the recent judgements in *People Over Wind* and *Grace and Sweetman*, raises a number of difficult legal questions regarding the balance to be struck between technological innovation in the field of renewable energy and environmental protection.[181]

First of all, the judicial standard of ‘no reasonable scientific doubt’ makes the line between ‘hypothetical risks’ and non-trivial uncertainty extremely thin. Hanekamp and Forrester observe that ‘a very high level of scepticism as to what science cannot deliver goes hand in hand with a very optimistic level of confidence regarding what science should be able to deliver’.[182] In this situation, ‘the line between real risk and mere conjecture may be practically imperceptible’.[183] It is settled case law that purely hypothetical risks cannot, in any circumstances, justify the application of the precautionary principle insofar as ‘zero risk’ does not exist.[184] Before the precautionary principle can be invoked to refuse development consent in the face of uncertain impacts, the seriousness of the risk must be real and not hypothetical.[185] Acting on hypothetical

[181] Célia Le Lièvre, ‘The judicial interpretation of the Habitats Directive by the CJEU: a high water mark for offshore renewable energy developers’ (2018) Journal of Energy and Natural Resource law, 1, 11
[182] Forrester and Hanekamp, ‘Precaution, Science and Jurisprudence: A Test Case’ (2006) 9(4) Journal of Risk Research, 297, 308
[183] Ibid.
[184] Cases T-13/99 *Pfizer Animal Health SA v. Council of the European Union* [2002] ECR II-03305, paras.143, 145 and 162; Case T-392/02 *Solvay Pharmaceuticals BV v. European Council* [2003] ECR II-4555, para.129
[185] *Pfizer Animal Health SA*, para. 143

risks would violate the general principle of proportionality.[186] 'Hypothetical risk' or trivial uncertainty is founded on mere conjecture which has not been 'scientifically verified' and as such, has not been fully demonstrated.[187] An obvious issue here is that a large number of potential ecological risks associated with the deployment of ORE technologies have not yet been verified with sufficient scientific backing and as such, these risks can still be considered as 'hypothetical'.[188] As emphasised in Chapter III, some interactions of the marine environment with ORE devices may be benign but in the absence of sufficient observation and empirical data, it is not possible to retire some important aspects of risks associated with collision, underwater noise and animal displacement. A number of risks associated with ORE projects have not been scientifically confirmed and as such, it is not currently possible for the scientific community to conclude, with absolute certainty, that these risks are sufficiently remote to exclude the application of the precautionary principle. We also simply 'don't know what we don't know'.[189] It is then conceivable that a 'hypothetical risk' may still constitute a 'reasonable scientific doubt' if the likelihood of it materialising cannot be completely ruled out on the basis of existing scientific knowledge. The application of the strict precautionary rules of the CJEU in this context would clearly depart from the 'evidence-based approach' recommended by the EC in its guidance on the precautionary principle. Although not legally binding, the EC guidance on the precautionary principle subordinates the adoption of precautionary actions to the proportionality principle.[190] In a radically different decision relating to public health concerns, the Court adopted a similar threshold of evidence, namely that of 'reasonable doubts' as to the safety of the Nifursol for human health to uphold the withdrawal of authorisation for that

[186] *Solvay Pharmaceuticals*, (n184), para.130
[187] *Pfizer Animal Health S.A*, (n184), paras.143, 146
[188] See further: Chapter III, section 2.1
[189] Brian Wynne, 'Uncertainty and Environmental Learning' (1992) 3 Global Environmental Change, 111, 114
[190] Further discussion on the proportionality principle and an evaluation of the proportionate character of the CJEU jurisprudence under Article 6(3) is provided by this author in section 6 of Chapter IV.

substance.[191] Interestingly, the Court subtly argued that such a low evidentiary threshold amounts to a 'zero risk tolerance' which 'does not refer to purely hypothetical risks and cannot therefore be compared to the concept of zero-risk'.[192] For the Court, the policy of 'strict zero tolerance' can be justified under the precautionary principle, and considering proportionality, to establish a total ban of an additive even in the case of uncertainty as to the extent of the potential risk to human health.[193] A full discussion on the proportionality principle will be given in section 6.2 of Chapter V. As first glance, it is worth noting that this reasoning seems hardly compatible with the proportionality principle when it comes to cases dealing with complex environmental risks.[194] With respect to environmental cases, knowledge is far less advanced than it is with respect to human health issues. In this vein, De Sadeleer observes that 'the obligation to take account of the most salient scientific findings does not warrant strict rules of evidence'.[195] The rationale behind this is that 'uncertainties are far more important in this field given the difficulty of predicting the reactions ecosystems to ecological risks'.[196] This holds even truer with regard to adjudications involving project developments in offshore areas. Achieving certainty beyond reasonable scientific doubt is extremely difficult for reasons that are inherent to the ecology of marine ecosystems. As discussed in Chapter III, the state of marine ecosystems is rarely known with absolute certainty due to the inherent difficulties of monitoring life underwater and in offshore environments.[197] Marine ecosystems are subject to a wide range of natural variations and stochastic fluctuations which means that no scientific investigation can reasonably meets the standard of no reasonable scientific doubt without prior experience

[191] *Solvay Pharmaceuticals*, paras.129, 146-147
[192] Ibid, para.150
[193] Ibid.
[194] See further discussion on the proportionality the CJEU jurisprudence in Chapter IV, section 6
[195] Nicolas De Sadeleer, *EU environmental law and internal market* (Oxford University Press, 2014), 77
[196] Ibid.
[197] Benjamin Planque, 'Projecting the future state of marine ecosystems, la "grande illusion"?' (2016) 73 ICES Journal of Marine Science, 204, 208

of monitoring in real sea conditions. Any new technology deployed in the marine environment creates a risk to marine biodiversity. This can be the case even if the devices are deployed outside marine N2000 areas. The procedural requirements of Article 6(3) are not limited to the geographical scope of N2000 sites and may equally apply to developments situated outside N2000 sites.[198] Where a site offers best conditions for biodiversity conservation, avoiding this site is preferable though avoiding N2000 sites may not necessarily retire risks in all circumstances. Connectivity in the marine environment contribute to exacerbating the 'ripple effect' or long-distance effect of localised impacts.[199] Lièvre *et al*., argue elsewhere that the mobile nature of marine mammals, seabirds and fish result in a high likelihood of connectivity between the location of development sites and N2000 sites.[200] Spatial areas of connectivity with marine N2000 features 'may extend over hundreds of kilometres reflecting the foraging and migratory use of the marine environment by many species'.[201] In other words, the risks are not necessarily removed by placing development sites in location remote from marine N2000 sites. Adverse effects may occur as a result of physical interactions/collisions with mobile protected species or alteration of ecological processes outside the vicinity of SPAs/SACs. The far-field effects of the in-water wakes of multiple offshore wind turbines, as described in more detail in Chapter II (section 2.4) and Chapter III (section 3.1), also provide an example of connectivity with offshore wind energy sites. Although the impacts of turbine wakes on local biodiversity remain unknown, their spatial extent has been shown to be significant (section 2.4, Chapter II).

Furthermore, it has been emphasised that conducting an AA entails determining whether a proposed development may cause long-term population changes such, that its

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[198] *Moorburg*, (n172), para.29

[199] Kimberly A. Selkoe and others, 'Principles for managing marine ecosystems prone to tipping points' (2015) 1(5) Ecosystem Health and Sustainability, 1, 4

[200] Lièvre C., O'Hagan A.M, Culloch R. Bennet F., (2016). 'Legal Feasibility of implementing a risk-based approach and compatibility with Natura 2000 network'. Deliverables 2.3 & 2.4 RiCORE project. 53pp., at 25

[201] Ibid.

implementation would compromise the achievement of specified N2000 sites' conservation objectives.[202] Understanding population-level impacts requires collecting data on species population dynamics (i.e. distribution and density) in order to estimate the number of animals predicted to be adversely affected by a development. Chapter III emphasised that a number of EISs for recent installed OWFs reported difficulties associated with tracking marine animals over large geographic areas.[203] Technical difficulties primarily stem from the paucity of representative data on ranging behaviour and population structure of marine species. Some data gaps are also simply too broad to be bridged by developers at the project-level.[204] The relatively small spatial scale of development sites combined with short timeframes and financial constraints of monitoring programmes mean that sample sizes are highly unlikely to cover important seasonal variation in many marine organisms.[205] As a result, all types of ORE projects including OWFs are highly likely to be 'Data-Rich Information-Poor', which as defined in section 5 of Chapter III, means that despite significant data collection, these data do not enable meaningful verification of predicted impacts.

In the absence of further scientific understanding, the interpretation of 'site integrity', when considered in conjunction with the legal test of 'no reasonable scientific doubt', places an unrealistic and impractical burden on ORE developers to provide sufficient evidence to convince licensing authorities that their projects will not, individually or in combination with other projects, adversely affect: 1) any marine habitat types or species in the vicinity of N2000 sites (directly); 2) any marine habitat types or species

[202] Paul M. Thompson and others, 'Framework for assessing impacts of pile-driving noise from offshore wind farm construction on harbour seal population' (2013) 43 Environmental Impact Assessment Review,73

[203] Vattenfall Wind Power Ltd., (2017). Thanet Extension Offshore Wind Farm. Preliminary Environmental Report. Chapter 7, paras. 7.5.7-7.58, at 10; Smart Wind Ltd., (2015) Hornsea Offshore Wind Farm Project Two. Environmental Statement Vol. 2 – Offshore, Chapter 4 Marine mammals (Report No UK06-050200-REP-0004), paras.4.6.133, 4.6.143, 4.6.144

[204] Clive J. Fox and others, 'Challenges and opportunities in monitoring the impacts of tidal-stream energy devices I marine vertebrates' (2018) 81 Renewable and Sustainable Energy Review, 1926, 1932, 1934

[205] Ilya Maclean and others, 'Evaluating the statistical power of detecting changes in the abundance of seabirds at sea' (2013) IBIS 155, 113, at 122-124

outside the vicinity of N2000 sites (indirectly) by connectivity with a nearby SPA/SAC, and, 3) any ecological processes (i.e. hydrodynamics, nutrient cycling, sediment transport) that contribute to sustaining the conservation status of marine N2000 features. This is not realistically achievable in light of the current state of scientific knowledge.

Practical difficulties in meeting the evidentiary standard set out under Article 6(3) of the Habitats Directive have recently resulted in a single tidal energy turbine withdrawing its application for a foreshore licence in Ireland. According to the development company, the additional bird surveys that were required to inform the AA process were beyond the timeline of the funding available to deploy and test the device.[206] Even in the context of OWF, another striking example is the withdrawal of Phase 2 of the London Array. Although the generating capacity of Phase 2 had been significantly scaled-down to reduce potential harmful effects on the red throated diver, three more years of data collection were required to reduce uncertainty as to the possible displacement effects on seabirds with no guarantee that these would be sufficient to satisfy licensing authorities that any impact on the birds 'would be acceptable'.[207]

Some commentators will always argue that the number of wind energy projects that have been denied development consents because of the rigid application of the precautionary principle of Article 6(3) of the Habitats Directive is very low.[208] This can be explained by the fact that offshore wind energy is now the most mature and viable offshore renewable energy technology. The offshore wind industry benefits from

[206] Lorna Siggins, 'Planning hitch forces renewables firm to pull Shannon project' *The Irish Time* (Dublin, 13 August, 2018)
[207] BBC News, 'Sea birds halt London Array wind farm extension' BBC (19 February 2014). <https://www.bbc.com/news/uk-england-26258271> (10 July 2018); See further: London Array, 'Phase Two'. <http://www.londonarray.com/the-project-3/phase-2/> (accessed 27 September 2018)
[208] Frins and Schoukens, Op. cit, (n11), 85

increasing financial attractiveness in investments with rapid cost reduction.[209] To date, 84% of total worldwide installed capacity is located in the EU,[210] with a total capacity of 15 MW deployed in 2017.[211] Offshore wind developers are in a stronger financial position and hence can afford to cover expensive monitoring campaigns to confidently inform regulatory decision-makers. Given their contribution to CO_2 abatement, large-scale OWFs are also more likely to get around a negative AA for imperative reasons of overriding public interest (IROPI).[212] Although the requirements laid down in Article 6(4) are said to be of restrictive application,[213] AG Sharpston points out that Article 6(4) does not create an 'insuperable obstacle to authorisation'.[214] The EC has consistently taken 'a soft glance'[215] at the question of whether large-scale developments with positive economic impacts could be considered as IROPI in the sense of Article 6(4).[216] The author will further develop this argument in section 6.2 of Chapter VI. At this stage, an overly demanding evidentiary threshold may result in only large-scale renewable energy projects being able to absorb extensive monitoring costs necessary to satisfy the standard of 'no reasonable scientific doubt' in the AA process.

At first glance, a rigid precautionary principle under Article 6(3) might seem to caution against any project that carries with it risks of local significant impacts on N2000 sites. However, by failing to account for some risk, we are now in a bizarre situation where the stringent interpretation of the precautionary principle under Article 6(3) may

[209] Brian Snyder and Mark J. Kaiser, 'Ecological and economic cost-benefits analysis of offshore wind energy' (2009) 34 Renewable Energy, 1567

[210] Global Wind Energy Council, (2018). Annual Market Update 2017 Global Wind Report. <http://gwec.net/publications/global-wind-report-2/> (accessed 2nd September 2018), at 54

[211] Wind Europe, Offshore wind in Europe: Key trends and statistics 2017 (February 2018). <https://windeurope.org/about-wind/statistics/offshore/european-offshore-wind-industry-key-trends-statistics-2017/> (accessed 20 March 2018)

[212] Habitats Directive, Article 6(4)

[213] Case C-239/04 *Commission v. Portugal* [2006] ECLI :EU :C:2006:665, para. 35; Joined Cases C-387/15 and 388/15 *Hilde Orleans and Others v. Vlaams Gewest* [2016] ECLI:EU:C: 2016:583, para.60

[214] Case C-258/11 *Sweetman*, Opinion of AG Sharpston, 22 November 2012, para. 66

[215] Andre Nollkaemper, 'Habitat Protection in European Community Law: Evolving Conceptions of a Balance of Interest' (1997) 9(2) Journal of Environmental Law, 271, 283

[216] Ludwig Krämer, 'The European Commission's Opinions under article 6(4) of the Habitats Directive' (2009) 21 Journal of Environmental Law, 59

become ‘paralyzing’ and ‘defective’.[217] The judicial standard of ‘no reasonable scientific doubt’ typically embodies what Wildavsky refers to as a ‘trial without error’[218] paradigm of risk management whereby ‘no change is allowed unless solid proof that the proposed undertaking is not harmful’;[219] ‘no trial without prior guarantees against error’.[220] ‘When in doubt, do nothing’.[221] Sunstein has already warned against such a strong ‘minimax’[222] application of the precautionary principle.[223] As observed by Sunstein, an absolutist precautionary principle would preclude the introduction of any desirable technological innovations ‘that make human lives easier, more convenient and healthier’.[224] By the same token, Wildavsky asserts that the precautionary principle in its extreme application would make even the smallest innovation impossible if it is suspected of entailing a risk.[225] Cooney argues that ‘doing nothing is often not an effective option in the conservation context’.[226] In the particular context of renewable energy technologies, applying such a strict precautionary principle ‘focuses on [very] a narrow aspect of what is at stake’.[227] Suspending a ‘Damoclean sword’[228] over innovative technologies that are necessary to abate one of the greatest environmental

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[217] Cass R. Sunstein, *Laws of Fear: Beyond the Precautionary Principle* (Cambridge University Press, 2005), 13

[218] Aaron Wildavsky, ‘Trial and error versus trial without error’ in Morris J., (ed.) *Rethinking Risk and the Precautionary Principle* (1st edn, Oxford: Butterworth-Heinemann, 2000), 22

[219] Ibid.

[220] Ibid, 23

[221] Nicolas De Sadeleer, ‘The effect of uncertainty on the threshold levels to which the precautionary principle appears to be subject’ in Applegate J., (eds.) *Environmental Risks* (vol. 2, Ashgate, Dartmouth, 2004), 29

[222] Cass R. Sunstein, ‘Beyond the Precautionary Principle’ (2003) 151 (3) University of Pennsylvania Law Review, 1003: A ‘minimax principle’ is described by Sunstein as a standard followed by regulator ‘in a situation of uncertainty, where existing knowledge does not permit regulators to assign probabilities to outcomes’. The ‘minimax principle’ consists of selecting precautionary measures/rules on the basis of the worst-case outcome scenario no matter how high the probability of occurrence of a hazard or severity of possible damage. See also: Patrick Jiang, ‘A Uniform Precautionary Principle Under EU Law’ (2014) 2(2) PKU Transnational Law Review, 490, 515

[223] Sunstein, (n217), at 13; See further: Cass R. Sunstein, ‘The Precautionary Principle as a basis for Decision-Making’ (2005) 2 The Economist’s Voice, 1

[224] Sunstein, (n217), at 25

[225] Aaron Wildavsky, (n218), at 30

[226] Rosie Cooney, ‘A long and winding road? Precaution to practice in biodiversity conservation’ in Fisher E., Jones J., Von Schomberg R., (eds.), *Implementing the Precautionary Principle: Perspectives and Prospects* (Edward Elgar, 2006), 23

[227] Sunstein, (n217), 15

[228] De Sadeleer, (n221), 29

threats, associated with impacts from climate change, will have far more dramatic consequences on biodiversity. Anthropogenic climate change is a major threat to biodiversity.[229] A recent study indicates that 35% of N2000 species are 'very highly' and 'extremely highly' vulnerable to climate change effects.[230] Hence, it is highly unlikely that the network of N2000 sites will yield the intended protection outcomes unless adequate climate change mitigation measures are taken to abate CO_2 emissions.

Setting a standard of proof that cannot be realistically met by developers of renewable energy technologies may paradoxically run afoul of the precautionary principle: it marginalises the role of science and this may, in the long-term, deprive both society and biodiversity of 'significant benefits' associated with climate change mitigation. What is more, imposing such a high request for certainty about uncertain [ecological] risks is also regarded as 'incompatible', 'if not contradictory, with the core of the precautionary principle which implies that neither proof nor evidence is available'.[231] Van Asselt and Vos point out that it is precisely 'the acknowledgment of the limits of science in providing conclusive evidence that has led to the development of the precautionary principle'.[232] Some authors go as far as to argue that setting a very high burden of proof 'could defeat the purpose of the precautionary principle' insofar as the very nature of the principle is to address scientific uncertainty.[233] Indeed, if the precautionary principle is interpreted in such a way that it precludes the achievement of best scientific evidence that is needed to effectively protect biodiversity from the long-term impacts of climate change, the application of the principle can hardly be considered as precautionary.

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[229] Millennium Ecosystem Assessment, *Ecosystems and Human Well-Being: A Framework for Assessment* (Island Press, 2003), at 10

[230] Claire Vos and others, 'Supplement: Managing Climate Change for the Natura 2000 Network – Assessment of the Vulnerability of Natura 2000 species and habitats for Climate Change: Species and Habitats Type Most at Risk (ENV B.3/SER/2010/0015r) (Alterra-Wageningen US 2012), at 30-31

[231] Marjolein B. Van Asselt and Ellen Vos, 'The Precautionary Principle and the Uncertainty Paradox' (2006) 9(4) Journal of Risk Research, 313, 317

[232] Ibid, 317

[233] Aline L. Jaeckel, *The International Sea-bed Authority and the Precautionary Principle: Balancing Deep Sea Mineral Mining and Marine Environmental Protection* (DPhil Thesis, Publications on Ocean Development, vol. 83, Brill Nojhoff, 2017), 170

Moyle elegantly writes on this aspect saying that an exclusive focus on avoiding risks makes the precautionary principle 'extremely timid': 'the fear of a loss ignores the potential conservation benefits that may be gained from different strategies'.[234] Combating global warming demands a better understanding of how low-carbon energy technologies interact with the receiving marine environment. Getting knowledge in turns, requires further monitoring and data collection. Setting a standard of proof that is too high to be passed by project developers to secure necessary development consent will inevitably reduce possibilities to deploy, monitor and learn from new renewable energy technologies in a way that would benefit biodiversity conservation by improving the state of scientific knowledge and future licensing decision-making. The consequence of taking a highly precautionary approach could lead to a situation where, as observed by Todt and Lujan, developers and regulators 'would never know what real benefits these technologies may bring'.[235] Likewise, they 'would also never understand if the possible negative effects really exist, and if so, if these effects can be resolved and minimized efficiently, or if they may turn out to be acceptable given the overwhelming benefits derived from the technology in question'.[236] In a similar line of thought, Copping and others argue elsewhere that, as far as the wave and tidal energy sector is concerned, 'there may be positive trade-off between environmental risks and performance of devices but these trade-offs can only be resolved once full-scale projects come online'.[237]

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[234] Brendan J. Moyle, 'Making the Precautionary Principle Work for Biodiversity: Avoiding Perverse Outcomes in Decision-Making Under Uncertainty' in Cooney R., Dickson B., (eds.), *Biodiversity ad the Precautionary Principle: Risk, Uncertainty and Practice in Conservation and Sustainable Use* (1st edn, Routledge, 2005), 159, 166

[235] Olivier Todt and José L. Lujan, 'Analysing Precautionary Regulation: Do Precaution, Science and Innovation Go Together?' (2014) 12 (34) Risk Analysis, 2163, 2166

[236] Ibid.

[237] Andrea Copping and others, 'The State of Knowledge for Environmental Effects: Driving Consenting/ Permitting for the Marine Renewable Energy Industry'. Report by Pacific Northwest National Laboratory (PNNL), 25

While it can be argued that the precautionary principle should not be operated to prohibit the deployment of technical innovation that has promising benefits for climate change mitigation,[238] on the other hand, pushing the precautionary principle too far, in the way of full relaxation, is not desirable either, as this would favour unproven and potentially harmful technologies. This is exactly what the precautionary principle was designed to avoid. The problem is therefore pervasive and epitomises the 'uncertainty paradox' of Van Asselt and Vos, i.e. the paradoxical position of regulatory decision-makers who 'increasingly rely on science for more certainty and conclusive evidence but science in turn, cannot deliver decisive evidence on uncertainty risks'.[239] There is therefore, a need to promote a 'middle ground' balancing principle. In situations where technological innovation is perceived to be necessary but the environmental consequences of these technologies are uncertain, the very nature of the precautionary principle should be to address scientific uncertainties in order to maximise the use of beneficial technologies while reducing undesired effects. As far back as 2006, Weiss urged that the precautionary principle should be complemented by the principles of adaptive management to make it compatible, and even, stimulate technological innovation.[240] The author shares the same view. Adaptive management, also distilled down as 'learning by doing',[241] is paramount to improve the merits of the precautionary principle in situations where, despite scientific uncertainty, there is a strong 'call for moving in the dark rather sitting still'.[242] An adaptive management procedure does not necessarily require having a high level of certainty before delivering necessary

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[238] Charles Weiss, 'Can there be science-based precaution?' (2006) 1 Environmental Research Letters, 1

[239] Van Asselt and Vos, (n231), 317

[240] Charles Weiss, (n238), 2

[241] Byron K. Williams, Robert C. Szaro, Carl D. Shapiro, 'Adaptive Management: The US Department of the Interior Technical Guide' (Adaptive Management Working Group, US Department of the Interior, Washington, DC 2009), at 7

[242] Holy Doremus, 'Precaution, Science and Learning While Doing in Natural Resource Management' (2007) 82 Washington Law Review, 547, 554

development consents.[243] However, it provides the process to 'improve relevant knowledge about dynamic ecological systems, while seeking to minimise risks associated with ongoing management' which are likely to arise as a result of decisions made on the basis of incomplete information.[244] The practical aspects of this management approach and its operational application to the ORE sector will be the core topic of Chapter VI.

The purposive approach of the CJEU has had a significant impact on how domestic courts interpret the assessment requirements of Article 6(3).[245] Domestic courts are bound by the interpretation of the CJEU by virtue of the doctrine of supremacy.[246] The subsequent section provides a short review of domestic case law from Ireland and the United Kingdom illustrating the difficulties and resources needed to inform an AA that meets the high evidentiary threshold of the CJEU.[247] Although the domestic case law identified primarily concerns judicial reviews of permissions for onshore renewable energy projects, it is worthy to note that domestic courts, have almost systematically, applied the judicial principles elaborated by the CJEU. It is therefore likely that a similar approach will be taken in future judicial reviews of development consents for offshore renewables.

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243 Rosie Cooney and Barney Dickson, 'Precautionary Principle, Precautionary Practice: Lessons and Insights' in Cooney R., Dickson B., (eds.), *Biodiversity ad the Precautionary Principle: Risk, Uncertainty and Practice in Conservation and Sustainable Use* (1st edn, Routledge, 2005), 304
244 David A. Keith and others, 'Uncertainty and adaptive management for biodiversity conservation' (2011) 114 Biological Conservation,1175, 1175
245 Lees, (n104), 99, 109
246 The doctrine of supremacy of EU law over domestic law was first enshrined by the CJEU in C-26/62 *Van Gen En Loos* [1963] ECLI:EU:C: 1963:1. The doctrine of supremacy extends to the CJEU jurisprudence by virtue of Article 220 TEU ('*The Court of Justice shall ensure that in the interpretation and application of the Treaty the law is observed'*) and Article 234 TEU ('*The Court shall have jurisdiction to give preliminary rulings concerning a) the interpretation of the Treaty, b) the validity and interpretation of acts of the Institutions of the Community').*
247 Justine Thornton, 'Significant UK Environmental Law Cases 2017/18' (2018) 30 Journal of Environmental Law, 343

5 - Application of the judicial principles of the CJEU by domestic Courts: a deployment challenge?

The recent judgement in *Mynydd Y Gwynt Ltd v. Secretary of State for Business Energy and Industrial Strategy*[248] illustrates the regulatory difficulties faced by developers of renewable energy projects to pass the legal test of no reasonable scientific doubt. By way of background, *Mynydd Y Gwynt Ltd* sought permission to install 27 wind energy turbines in Wales. At issue was the effect of the proposed wind energy development on the red kite population of the neighbouring Elenydd Mallean SPA. The conservation objectives of the SPA were to support at least 15 pairs of breeding red kites. The Secretary of State refused to grant development consent on the grounds that she was not satisfied that the project, alone or in combination with other projects, would not have a detrimental effect on a protected population of red kite as a result of the risk of collision with turbine blades. A number of uncertainties had not been addressed by the development company including, inter alia, the reliability of bird survey data, the proportion of red kites coming from the nearby SPA, the effectiveness of mitigation measures and the level of mortality from collision that the red kite population could sustain before the site's conservation objectives would be undermined. The claimant (Mynydd Y Gwynt Ltd) relied on extensive survey data from 2009 to 2015 and guidance provided by Scottish National Heritage (SNH) to argue that there was no connectivity with the Elenydd Mallean SPA in that the proposed development was located more than 4 km away from the SPA and no nesting activities had been identified within 6 km. The maximum foraging range of red kites during the breeding season was

[248] *Mynydd Y Gwynt Limited v. The Secretary of State for Business, Energy and Industrial Strategy* [2018] EWCA Civ 231 (Mynydd Y Gwynt Limited)

established at 6 km by the SNH guidance. On this basis, the claimant contended that there would be no real risk that the red kites would come from the SPA to forage. Natural Resources Wales (NRW) required additional survey work within 10 km of the proposed development site to account for the bird's foraging range during non-breeding seasons (although no such a requirement was contained in the SNH guidance). NRW argued that Mynydd y Gwynt had no data to demonstrate the origins of the red kites using the proposed development site. Therefore, it could not be shown that the wind farm, alone or in combination with other projects, would not have likely significant effect on the SPA. In light of the precautionary principle, NRW's stance was that it should be assumed that red kite birds came from the SPA. The developer commissioned further surveys but NRW maintained its position**.** NRW's conclusion was not that there was a real risk to the kite population, but rather that Mynnyd y Gwynt had not provided enough evidence to show that such a risk on the site's conservation objectives could be excluded. Unlike NRW, the Examiner concluded that, in light of up-to-date survey data, a reasonable degree of certainty had been reached to demonstrate that red kites did not originate from the SPA and that consequently, the project would not result in a likely significant effect on the site. Despite this, the Secretary of State requested further information from NRW and Mynnyd y Gwynt on the maximum morality rates that could occur without adversely affecting the integrity of the SPA. Mynnyd y Gwynt responded to some of the issues raised by the Secretary of State but failed to provide further information about the red kite population. The Secretary of State agreed with NRW that the development company had not demonstrated beyond all reasonable scientific doubt that the red kite did not come from the SPA. She therefore turned down the application on the ground that there were some risks that the red kites using the site would originate from the SPA. Mynydd Y Gwynt Ltd appealed the decision on the grounds that the Secretary of State erred in her approach by requiring 'absolute certainty' with respect to each element of the assessment (i.e. mortality rate and the proportion of red kites and the proportion of re kites coming from the SPA) instead of using available data to consider 'the matter as a whole' and make a reasoned judgment in making the assessment rather than ruling on the basis of the 'worst possible hypothesis' (100% of red kites were coming from the SPA).[249] At the first instance, the High Court held that the burden of proof was on Mynydd y Gwnyt in the sense that it was up to the applicant to provide sufficient information to convince the Secretary of State that there was no real risk of adverse effects as to the integrity of the red kite feature of the SPA.[250] In summary, the High Court concluded that Mynnyd y Gwynt had failed to provide information reasonably required to determine the appropriate assessment. The Secretary of State had, however, done the best she could on the available information. Therefore, the approach cannot be said to have been wrong in law.[251] The Court of Appeal agreed that the Secretary of State had acted lawfully.[252] Mynydd Y Gwynt attempted to argue that the Secretary of State went too far by requiring absolute certainty on the issue. The Court dismissed the appeal. The Secretary of State was not asking for absolute certainty about the red kite population, rather, the Court held that the Secretary of State required clarity.[253] The Secretary of State was thus entitled to conclude that 'such clarity was not provided by the information before her'.[254]According to the Court, the legal test of 'no reasonable scientific doubt', does not mean imposing a strict legal burden of proof upon one party. Instead, it means 'no more that it is in the interest of the applicant to provide the information necessary to enable favourable decision to be made'.[255]

[249] *Mynydd Y Gwynt Limited* [2016] EWHC 2581, para. 48; *Mynydd Y Gwynt Limited* [2018] EWCA Civ 231, para. 22
[250] Ibid, para. 67 (i)
[251] Ibid, para. 67 (xvi)
[252] *Mynydd Y Gwynt Limited* [2018] EWCA Civ 231, para. 26
[253] Ibid, para.34
[254] Ibid, para. 34
[255] Ibid, para.31

That said, whilst it is for the competent authorities to undertake the AA process, the onus is on the proponent of the project to provide the information necessary to secure the approval.[256] The *Mynydd y Gwynt Ltd* case concerned visible red kite birds on land. Establishing, beyond reasonable scientific doubt, the absence of connectivity with nearby marine N2000 areas might be even more challenging due to difficulties in monitoring species offshore or below the water surface. Providing more data or information is expensive and time consuming.[257] This responsibility should not be borne solely by developers of renewable energy technologies under the framework of licensing procedures. With respect to seabirds, Furness *et al.*, rightly demonstrate that it is not currently possible to know with absolute certainty the colonies that sea birds come from unless strategic ringing programmes are undertaken.[258]

In Ireland in *Kelly v An Bord Pleanála,*[259] the applicant was seeking orders of certiorari to quash the authorisation granted by An Bord Pleanála, the Irish statutory planning authority, for two wind farm developments in Roscommon (Ireland). The legal grounds upon which judicial review was sought were that the Natura Impact Statements provided by the developer were inadequate in that they did not meet the requirements of Article 6(3) of the Habitats Directive and jurisprudence based thereon. The applicant equally contended that An Bord Pleanála failed to carry out AAs which met the judicial criteria of the CJEU and to give reasons for its determination in the AAs. The proposed developments consisted in two wind farms of 16 and 19 turbines respectively, located in the same vicinity of N2000 sites hosting bird species of national and EU interest. Phase

[256] Craig Whelton and Lynsey Reid, 'Providing information to enable the decision-taker to make an appropriate assessment' (2018) 186 Scottish Planning and Environmental Law, 45
[257] Ibid.
[258] Robert W. Furness and Sarah Wanless, 'Quantifying the impact of offshore wind farms on Gannet populations: a strategic ringing project' (2014) 29 (2) Ringing & Migration, 81
[259] *Kelly v. An Bord Pleanála* [2014] IEHC 400

1 (wind farm 1) was located within 10 kilometres of 10 N2000 sites. Phase 2 (wind farm 2) was planned within 15 km of 14 Natura sites hosting bird species of national and EU interest. The main concerns included *inter alia*: 1) the displacement of Golden Plover and Lapwing birds; 2) the disturbance of feeding/ roosting/ commuting areas and natural flight lines of a number of protected birds; and 3) collision strike with wind turbines.

With respect to the first ground of concern, the Inspector from the Board agreed that, given the extensive and alternative habitats available to the target species, there was unlikely to be any significant long-term impact. However, regarding the second ground of concern, the Inspector argued that the level of information provided by the developer was insufficient. The Inspector was also of the view that a higher burden of proof must be required to demonstrate the absence of adverse effects on the integrity of the SPA. In particular, the Inspector argued that the survey did not address the interconnections between the conservation sites and failed to submit information on flight patterns of Greenland White-Fronted Geese. The Inspector further stressed that the developer did not provide adequate information to prove beyond all reasonable scientific doubt that Phase 1 of the wind farm developments would not impact the feeding, roosting, commuting area and natural flight lines of protected bird species and the integrity of their conservation sites. Likewise, the developer had not proven beyond reasonable scientific doubt that the proposed turbine heights would not adversely affect the integrity of the SPA as a result of bird strikes. Furthermore, the Inspector argued that the construction of the wind farms within the karstic layer may significantly alter the recharge of the turlough habitats (Lough Croan SAC) from groundwater flow patterns. The alteration of water flow would have a significant impact on the ecology of the area. The Natura Impact Statement indicated that these matters would be addressed following further investigations to determine the design of turbine bases. Nevertheless, the Inspector from the Board was of the view that a higher burden of proof must be required to demonstrate the absence of adverse effects on the integrity of Lough Croan. An Bord Pleanála took a different view. In light of the substantial survey works carried out by the developer, together with comprehensive data and information submitted to the Board, An Bord Pleanála considered that the proposed development would not adversely affect the integrity of the N2000 sites concerned. An Bord Pleanála was satisfied that the wind farms could be developed with no significant effect on the hydrology or hydrogeology of the area. An Bord Pleanála further considered that in light of the comprehensive additional data on feeding/ roosting/ commuting area and natural flight lines of birds, the integrity of the sites would not be adversely affected. An Bord Pleanála adopted a similar determination with respect to Phase 2. Whilst An Bord Pleanála has the ability to disagree with its own Inspector, the Bord has to provide the reasons for departing from the Inspector's conclusions. In the absence of such determination, the Irish High Court held that An Bord Pleanála did not have jurisdiction to grant permissions. The ruling of the Court reads as follow:

> 'My conclusion is that, on the evidence before the Court, the Board has failed to carry out an appropriate assessment which meets the requirements of Article 6(3) of the Habitats Directive, as explained by the CJEU. There is no evidence before the Court of an assessment conducted by the Board which meets the criteria set out at paragraph 40 [of the *Sweetman* judgement] and identifies, in the light of the best scientific knowledge in the field, all aspects of the proposed development [...] and contains complete, precise and definitive findings and conclusions which the Board considers capable of removing all reasonable scientific doubt as to the effects of the

proposed development on the integrity of a number of N2000 sites close to the site of the proposed development'.[260]

The Supreme Court went on to consider that

> 'The findings and conclusions reached by the Inspector in relation to the matters identified as potentially affecting the integrity of N2000 sites are such that the appropriate assessment in the Inspector's report could not support a determination that the proposed development would not adversely affect the European sites, having regard to their conservation objectives when considered by the Court in accordance with established judicial review principles'.[261]

The determination made by the Bord cannot therefore be considered as lawful unless such determination is made as part of an AA lawfully conducted.[262] By reason of this failure, An Bord Pleanála had failed to carry out a proper AA process which met the criteria of the European jurisprudence namely, an AA based on complete, precise, definitive findings and conclusions capable of removing all reasonable scientific doubt.[263] It is not clear whether the Court would have taken a similar decision if the Bord had explicitly provided the reasons for departing from its Inspector's recommendations. In Ireland, it is settled case law that An Bord Pleanála must indicate the reasons for its determination.[264] To date, most judicial reviews of permissions for wind farms in Ireland relate to internal failures at An Bord Pleanála to comply with its

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[260] *Kelly v. An Bord Pleanála* [2014] IEHC 400, paras.67-68
[261] Ibid, para. 77
[262] Ibid, para. 68
[263] Ibid, paras. 67,68, 81
[264] *Christian v. Dublin City Council* [2012] IEHC 163; *Connolly v. An Bord Pleanála* [2016] IEHC 322; *Baltz v. An Bord Pleanála* [2016] IEHC 134

statutory obligation to adequately reason its decisions[265] under the Planning and Development Acts.[266]

In *Bagmoor Wind Ltd v Scottish Ministers,*[267] the Scottish Court of Session relied on *Waddenzee* to uphold the decision of the Scottish Ministers refusing to grant development consent to Bagmoor Wind Ltd Company on the grounds that adverse effects on the integrity of the Glen Etive and Glen Fyne SPA could not be excluded beyond reasonable doubt. It was agreed that the integrity of the SPA would be affected in the event where only one pair of eagles (over a total of 19 pairs being present) is eliminated either by collision or by abandonment of a territory of the SPA. According to the Court, despite an avoidance figure of 99% (or 0.015 collisions per year) of golden eagle, the possibility of abandonment of a portion of territory was not excluded beyond reasonable scientific doubt.[268] Indeed, such a high avoidance rate confirmed that there was a displacement risk and that this could lead to abandonment of territory by eagles thus producing a risk of adverse effect on the integrity of the SPA.

Other national jurisprudence exhibits a more flexible application of the precautionary principle. In a recent decision involving *People Over Wind* and *An Bord Pleanála,*[269] the Irish Court of Appeal introduced a refinement to the notion of 'best scientific knowledge' arguing that 'best scientific knowledge' refers to scientific knowledge which is 'reasonably available'.[270] According to the Court, the objective of the '*Waddenzee* formula' is to ensure that an AA 'meets proper contemporary standards' and 'that the integrity of the SAC is not compromised by the grant of permission which is in turn premised on a scientific analysis which is out-dated, flawed or which does not

265 Michael M. O'Connor, 'Social Acceptability of Wind Farm Development: A Judicial Eye at the Centre of the Perfect Storm (Part 1)' (2018) 25 (1) Irish Planning and Environmental Law Journal, 4, 6-9
266 Planning and Development Act 2000 (as amended), sect.172(1H), sect. 177V (1)
267 *Bagmoor Wind Ltd v. The Scottish Ministers* [2012] CSIH 93
268 Ibid, paras.53-55
269 *People Over Wind, Environmental Action Alliance Ireland v. An Bord Pleanála* [2015] IECA 272
270 Ibid, para. 50

measure up to state of the art scientific understanding'.[271] The applicants were seeking judicial review of a decision authorising the construction of a wind farm situated 12 to 17 km from two SACs in Co. Laois, one of which included the River Barrow and River Nore SAC. At issue was the vulnerability of the protected fauna to the risk of increased sedimentation in these watercourses during the construction phase of wind farm development. These rivers constitute a habitat for the Irish subspecies of the Nore freshwater pearl mussel (*Margaritifera durrovensis*), listed in Annex II of the Habitats Directive. The concern was that run-off from the construction activities would contain high levels of sediment which would drain into the River Nore, thereby placing further pressure on the pearl mussel. The questions submitted to the Court concerned the nature of the obligation on An Bord Pleanála when evaluating best scientific evidence for the purpose of conducting an AA. The Court of Appeal held that the obligation of An Bord Pleanála is to have to the best scientific knowledge which is 'reasonably accessible'. That said, the Court noted that a 'hugely detailed environmental assessment concerning every relevant scientific and environmental aspect' of the wind farm was prepared with 21 mitigation measures all of which were designed to mitigate the risk of contamination by sediment release. On the basis of these documentary materials, the Court of Appeal ruled that 'there was no suggestion at all that the Board did not have available to it the best scientific knowledge' reasonably available.[272] The AA carried out by An Bord Pleanála 'met the *Sweetman* requirements in that it has demonstrated to the necessary degree of certainty that the integrity of the SAC will not be affected by the proposed works'.[273] The Irish Supreme Court refused to refer the question related to the interpretation of 'best scientific knowledge' to the CJEU.[274] It is not clear whether the interpretation of the Court of Appeal would have survived scrutiny by the CJEU. he

[271] Ibid, para.25
[272] Ibid, para.52
[273] Ibid, paras. 47-48
[274] *People Over Wind, Environmental Action Alliance Ireland v. An Bord Pleanála* [2016] IESCDET 21, para.38

Supreme Court held that the question of whether the materials before the Board was 'best scientific knowledge' is a question of fact and does not give rise to an issue of law. Both the Court of Appeal and the Supreme Court refused to refer the question of interpretation to the CJEU on the ground that the case did not raise any issue or question of interpretation. According to the Supreme Court, sufficient certainty could be found in the words of Article 6(3) and jurisprudence of the CJEU.[275]

Following the grant of development consent for the construction works, the developer (Coillte Teoranta) subsequently addressed the question of connecting the wind farm concerned to the electricity grid by means of a cable. An application for leave to appeal was made by *People Over Wind* (the applicant) to the Irish High Court. The dispute in the main proceedings concerned whether Coillte Teoranta erred in taking mitigation measures into consideration at the screening stage to determine if it was necessary to carry out an AA with respect to the laying of a connecting cable. The High Court decided to refer the question to the CJEU for preliminary ruling.[276] The CJEU reaffirmed the application of the strict precautionary standards of authorisation under Article 6(3).[277] As mentioned above, the CJEU held that is not appropriate to take into account mitigation measures at the screening stage as this would deprive the appropriate assessment of its purpose and create a risk of circumvention of that stage which constitutes an essential safeguard provided by the Habitats Directive.[278] Unfortunately, the CJEU did not have the opportunity to confirm whether the flexible understanding of the standard of 'best scientific knowledge' proposed by the Irish Court of Appeal would be sufficient to meet the standard of 'no reasonable scientific doubt' of Article 6(3).

[275] Ibid, para.38
[276] *People Over Wind and Sweetman v. Coillte Teoranta* [2017] IEHC 171
[277] Case C-323/17 *People Over Wind and Sweetman v. Coillte Teoranta* [2018] ECLI: EU: C: 2018:244, paras. 37-40
[278] *People Over Wind and Sweetman*, paras. 37-40

Overall, the decision of the Irish Court of Appeal in *People Over Wind* [2015] raises the question of the standard of judicial review domestic courts are entitled to apply in cases involving quality of complex scientific evidence. Interestingly, the CJEU requires that projects are examined using 'best scientific knowledge in the field' but does not clearly define what 'best scientific knowledge' means for the purpose of this appraisal. The CJEU case law would suggest that, in the face of opposing scientific hypothesises or opinions, competent authorities shall conclude that a reasonable scientific doubt exists.[279] This interpretation of scientific uncertainty was upheld by the Court of First Instance (CFI) in the *Pfizer* case.[280] In *Pfizer*, the CFI had to rule on the validity of the Regulation 2821/98 of the European Council banning the use of four antibiotics in animal foodstuffs including the drug virginiamycin. Divergent scientific opinions were opposed by the Scientific Committee on Animal Nutrition (SCAN) and national expert bodies as to whether virginiamycin constituted a risk to human health by contributing to the growth of antibiotic resistance in humans. Although the CFI made it clear that 'it is not for the Court to assess the merits of either of the scientific points argued before it',[281] the CFI interpreted scientific uncertainty as contrasting scientific opinions to justify the application of a precautionary ban on virginiamycin.[282] Since dissenting scientific opinions are likely to found in all uncertain risk cases,[283] legal scholars have contended that such an interpretation of uncertainty renders empty the precautionary principle.[284] In the context of the Habitats Directive, this interpretation would prevent competent authorities from authorising a project under Article 6(3) whenever one qualified scientific body takes a divergent opinion on whether a project would adversely

[279] Peter Scott, 'Appropriate Assessment: A Paper Tiger' in Jones G., (ed.) *The Habitats Directive: A Developer's Obstacle Course?* (Hart Publishing, 2012), 103
[280] Case T-13/99 *Pfizer Animal Health SA* [2002] ECR II-03305
[281] Ibid, para. 393
[282] Anne-May Janssen and Marjolein B. Van Asselt., 'The Precautionary Principle in Court – An analysis of Post-Pfizer Case Law' in Van Asselt M., Versluis E., Vos E., (eds)., *Balancing between trade and risk: Integrating legal and social science perspectives* (London: UK: Routledge, 2013), 197
[283] Van Asselt and Vos, (2006), (n231), 329
[284] Ibid, 329; Janssen and Van Asselt, (n282), 198

affect the integrity of N2000 sites. *RSPB v. Scottish Ministers* [2017] is a seminal case in this respect.[285] At First Instance, the Scottish Court of Session (Outer House)[286] had to decide whether the conclusions of the AA carried out for a group of substantial offshore wind farms[287] comprising a total of 335 wind turbines, were capable of removing all reasonable scientific doubt by giving complete, precise and definitive findings using the best scientific means. By the same token, the litigation concerned the question of whether the findings of a contested scientific fact or methodology were capable of judicial review. The scope of the court's powers of review was placed into sharp focus. The modelling options and statistical method (i.e. scalar methodology) relied upon by the consenting body, Marine Scotland, to identify thresholds of acceptable biological change on the bird populations of two SPAs were not approved by SNH. SNH advised the use of an alternative method, the 'reduced uncertainty' ABC (ruABC). In the Outer House, the Lord Ordinary was therefore not satisfied that scalar was the best scientific means capable of providing the best evidence. The Lord Ordinary found that the conclusion of the AA did not satisfy the legal test in that its conclusions were not capable of removing all reasonable scientific doubt. By relying on the scalar-derived thresholds, 'Marine Scotland, as an assessor, made a mistake which flaws the appropriate assessment'.[288] Whether as an assessor or as a decision-maker, Marine Scotland was not entitled to conclude beyond reasonable doubt that adverse effects on the integrity of the Forth Islands and Fowlsheugh SPAs were excluded.[289] The decision was then quashed in the Inner House on the grounds that the standard of review that the Court should apply when assessing the legality of an AA is that of manifest error of assessment,[290] being the same test of judicial review set out in *Wednesbury*[291] and

[285] *RSPB v. Scottish Ministers* [2017] CSIH 31
[286] *RSPB v. Scottish Ministers* [2016] CSOH 103
[287] Inch Cape, Neart Na Gaoithe, Seagreen Alpha an Seagreen Bravo
[288] *RSPB v. Scottish Ministers* [2016] CSOH 103, para. 227
[289] Ibid.
[290] *RSPB v. Scottish Ministers* [2017] CSIH 31, para. 203

applied by the CJEU (see infra). The Court held that the Lord Ordinary 'trespassed into the province of the fact finder'.[292] The judgement of the Outer House was of an evaluative scientific nature. 'Even if there may be errors identified upon a close scrutiny of the data or methodology, none could be described as manifest'.[293] The ruling of the Inner House reads as follows:

> 'Sometimes, of necessity, the Court will have to grapple with difficult scientific concepts. Where that is required, the approach in England & Wales is to require the public authority to provide a sufficient account of the facts, and how the relevant science relates to them, to enable the Court to consider whether the decision involves an error of law or an abuse of discretion. That is entirely reasonable. However, it is not the function of the Court, in a judicial review, to decide between differing views of experts in a technical area'.[294]

The Court went on to consider that

> The Lord Ordinary clearly spent an extraordinary amount of time and effort analysing the scientific methodology. [...] The rationale behind his thinking must have been his expression of what he regarded as a legal test; that being whether the AA's conclusions were capable of removing all reasonable doubt. Yet the existence, or otherwise, of a reasonable doubt is primarily a matter of fact for the decision-maker (and not a judicial reviewer) to determine.[295]

The Inner House concluded that Marine Scotland was not obliged to depart from the scientific judgement that its own expert (Marine Scotland Science) had been applying. They were entitled to make the scientific judgement that the methods which they had adopted were the best available in the circumstances. In the AA, Marine Scotland

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[291] *Associated Provincial Picture Houses v. Wednesbury Corporation* [1948] 1 K.B. 223
[292] *RSPB v. Scottish Ministers* [2017] CSIH 31, para. 221
[293] Ibid,
[294] Ibid., para.204
[295] Ibid, para.206

applied the correct precautionary principle that a development could only be authorised if no reasonable scientific doubt remained that the integrity of the sites would not be adversely affected. [...] That was an evaluative judgement which they were, as experts in the field, entitled to make in concluding as a matter of fact that no reasonable scientific doubt remained. There is no sound basis in law for reviewing that finding.[296]

In other words, the existence of a reasonable scientific doubt under the *Waddenzee* test remains primarily a matter of fact to be appreciated by the decision-maker and not the judicial reviewer. *RSPB v. Scottish Ministers* clearly highlights the fact that divergent scientific opinions may be opposed regarding the monitoring methodologies or parameters utilised in scientific models. Scientific models may generate imprecise modelling outputs and these scientific limitations can be invoked against the legality of AAs. Furthermore, it raises the more general question of the standard of review domestic courts are entitled to apply when complex scientific data are involved. Where the CJEU held that the standard of review to be applied with respect to environmental assessments is that of 'manifest error of assessment' or 'misuse of power'[297] staying within the limits of this narrow control may not be straightforward where the legality of an AA is closely linked to the capacity of scientific evidence to remove all reasonable scientific doubt. The legal test of 'no reasonable scientific doubt' may reinforce what some lawyers refer to as 'scientification' of judicial reviews,[298] a practice in which Courts act as a 'super risk assessor'[299] extending their review to the scientific merits

[296] Ibid, para.214.
[297] Case C-425/08 *Enviro Tech (Europe) v. Belgian State* [2009] ECR I-10035, para. 47; Case C-343/09 *Afton Chemical Limited v. Secretary of State for Transport* [2010] ECR I-07027, para. 28.; Case C-77/09 *Gowan Commércio Internacional e Serviços L* [2010] ECR I-13533, para. 56
[298] Anne-May Janssen and Nele F. Rosenstock, 'Handling Uncertain Risks: An Inconsistent Application of Standards? The Precautionary Principle in Court Revisited' (2016) 7(1) European Journal of Risk Regulation, 144, 146
[299] Ibid, 154

underlying contested decisions.[300] The process of 'scientification' of judicial reviews has been highlighted as a problematic tension in case law involving uncertainty and uncertain risks.[301] Chalmers *et al*., observe that European Courts increasingly move towards 'a proceduralist test of whether a sufficiently rigorous risk assessment has been carried out'.[302] Since the existence of scientific uncertainty is the triggering factor that prompts the application of the precautionary principle, Courts tend to adopt a new role by 'increasingly paying attention to science underlying the [planning] decision-making'.[303] Besides the evident regulatory barriers that such a high standard of proof creates for the consenting of ORE projects, the legal test of 'no reasonable scientific doubt' may also increase the risk that national judges, with no scientific expertise, erroneously interpret complex scientific data and methodologies to upheld 'non-environmentally friendly' development consents or to turn down projects with relatively low risk of adverse effects. This may also add an important degree of legal uncertainty in judicial review of future development consents.

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[300] Anne-May Van Asselt and Ellen Vos, 'The Role of Science in political and judicial decision-making' in Micklitz H.W., Tridimas T., (eds.) *Risk and EU Law* (Edward Elgar, 2015), 126
[301] Ellen Vos, 'EU Risk Regulation reviewed by the European Courts' in Van Asselt M., Everson M., Vos E., (eds), *Trade, health and the Environment: The European Union puts the Test* (Routledge, 2014), 213
[302] Damian Chalmers, Gareth Davies, Giorgio Monti, *European Union Law: Cases and Materials* (2nd, edn., Cambridge: Cambridge University Press, 2010), 898
[303] Van Asselt and Vos, (n300), 127

6 - Conclusion

Although the Habitats Directive does not create a general ban on new ORE technologies,[304] the judicial interpretation of the assessment requirements of Article 6(3) sets a very high standard of proof which cannot be realistically met in the marine environment. The CJEU case law favours a 'criminal-like' standard of proof whereby developers must provide necessary evidence to inform national regulatory authorities 'beyond all reasonable scientific doubt' about the absence of threats to the integrity of nearby marine N2000 sites.[305] In a similar approach, the Court also prescribes a precautionary and purposive approach to interpretation of the notion 'integrity of the site' in order to assess the implications of new developments for N2000 sites.[306] The purposive method may have been envisaged by the Court to address situations of scientific uncertainty under the so-called doctrine of 'effectiveness' or *effet utile*.[307] However, it clearly contributes to exacerbating existing regulatory barriers on the ORE sector by placing an unrealistic onus on developers to prove the absence of threat with nearby N2000 areas.

Interestingly, the Fitness Check of the Birds and Habitats Directive acknowledges that 'some respondents have suggested that national court rulings may have reduced the scope for flexibility in applying some provisions of the Directives' but that the evidence presented by them 'was not conclusive'.[308] In the particular context of ORE technologies, this Chapter has demonstrated that the strict interpretation of the precautionary principle under Article 6(3) epitomises an inflexible application of the

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[304] *Azienda Agro-Zootenica Franchini Sarl*, (n93), para.46
[305] *Waddenzee*, paras. 56- 59
[306] Case C-258/11 *Sweetman and Others v. An Bord Pleanála* [2013] ECLI:EU:C: 2013:220
[307] Fennelly, (1996), (n113), 656
[308] European Commission, 'Fitness Check of the European Legislation (Birds and Habitats Directive)' (Commission Staff Working Document) SWD (2016) 472 final, at 64

Habitats Directive. A significant mismatch exists between the high evidentiary standard of 'no reasonable scientific doubt' and the current state of art of scientific knowledge of marine ecosystems. Predicting and understanding the potential environmental impacts of any novel renewable energy technology deployed in dynamic marine environments is also extremely challenging and costly. Data collection in the marine environment can cost millions and take a number of years to complete. What is more, science is never ascertainable. Science is empirical and deals with nature as it exists. The primary criterion and standard of evaluation of scientific theory is evidence, not proof. Given our limited understanding of marine ecosystems, it is likely that nascent ORE technologies will always have inherent scientific uncertainty associated with them. It is therefore unreasonable to expect developers to fully inform decision-makers beyond all reasonable scientific doubt. The judicial understanding of the precautionary principle under Article 6(3) was first crystallised in the seminal *Waddenzee* case.[309] At that time, N2000 sites were predominantly designated on land[310] and the ORE sector represented a marginal proportion of our energy mix.[311] If the strict application of the precautionary principle of Article 6(3) is to be upheld in future planning permissions, this may result in any novel renewable energy technology suffering from disproportionate scrutiny and a low level of certainty for investors.[312] From there, the strict jurisprudence of the Court may need to be revisited in light of the controversial Innovation Principle[313] which

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[309] Case C-127/02 *Waddenzee* [2004] ECR I-07405

[310] Natura 2000 network: European Commission, (2004). Report from the Commission on the implementation of the Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna (Communication) COM (2003) 845 final; Network of SPA: Europe Commission, (2011) EU Composite Report in accordance with Article 12. Period covered 2005-2007. Available at <http://ec.europa.eu/environment/nature/knowledge/rep_birds/index_en.htm> (12 April 2017).

[311] Wind Europe, 'Offshore wind in Europe: Key Trends and Statistics 2017' (February 2018): In 2004 the annual cumulative offshore wind installed capacity in the EU did not exceed 2GW compared to 16 GW in 2018.

[312] Stephanie Merry 'Marine renewable energy: could environmental concerns kill off an environmentally friendly industry?' (2014) 32(1) Underwater Technology, 1

[313] See further on the discourse surrounding the so-called Innovation Principle: Van Calster G., Garnett K., Reins L., (2017). 'On a Need to Have Basis: The innovation principle, the rule of law, and EU regulation of new technologies' in Eckes C., Cseres K.J., Weimer M., (eds), (2017) The Rule of Law in the Technological Age Challenges and Opportunities for the EU (Collected Papers, ACELG 6th Annual Conference, 4 November 2016, Amsterdam Centre for European Law and Governance), at 47

requires that the negative effects of legislations and policies on innovation are fully assessed.[314]

This particular interpretation of the precautionary principle under Article 6(3) is however a pure creation of the Court. This is certainly not what is required by the precautionary principle as formulated under the system of the EU Treaties. The precautionary principle cannot be understood to require such a strongly restrictive approach in the renewable energy sector. Whilst the precautionary principle is obviously a central pillar of EU environmental policy aiming at a 'high level of environmental protection',[315] the precautionary principle of Article 6(3) 'does not stand alone in the a*cquis communautaire*'.[316] The formalisation of sustainable development as an overarching objective of the environmental integration principle of Article 11 TFEU is of high significance in this respect in that it 'tells us the direction that EU law is taking or should be taking'.[317]

Sunstein contends that an overly strict precautionary principle in the particular context of innovative technologies may be described as a 'crude and sometimes perverse way of promoting [biodiversity] goals which can be obtained through other [less restrictive] routes'.[318] A better route exists. Given the poor conservation status of biodiversity in the European Union,[319] in particular the marine habitats types protected under the

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314 European Commission, 'Towards an Innovation Principle Endorsed by Better Regulation' (2016) 14 EPSC Legal notes.
315 TFEU, Article 191(2)
316 Frederik Kistenkas, 'Rethinking European Nature Conservation Legislation: Towards Sustainable Development' (2013) 10 (1) Journal for European Environmental and Planning Law, 72, 79
317 Beate Sjåfjell, 'The legal significance of Article 11 TFEU for EU Institutions and Member States' in B. Sjåfjell, A. Wiesbrock (eds.) *The Greening of European Business under EU Law: Taking Article 11 TFEU Seriously* (Routledge, 2015), 51
318 Sunstein, (n217), 34
319 European Commission, 'The State of Nature in the European Union' (Communication) COM (2015) 219 final, at 105-116

Habitats Directive,[320] it is clear that a relaxation of the protection scheme of the Habitats Directive is excluded. However, refinement of the precautionary principle makes sense so as to reconcile the important objectives for renewable energy and biodiversity conservation. A major question arises as to whether there is not an alternative way to protect marine biodiversity while promoting the exploitation of low-carbon energy sources at sea. An explicit approach to adaptive management tied to ongoing environmental monitoring may give us a way to do so. This will be the core topic of Chapters VI and VII. Before moving to Chapter VI, it is important to consider the relationship between energy and environmental policy under the legal system of the Lisbon Treaty. Likewise, the author will also position the ORE sector and the jurisprudence of the Court within the underlying requirements of the proportionality principle and the objective of sustainable development. This forms the focus of the following Chapter.

[320] Ibid. The latest State of Nature indicates that 39% of assessment of conservation status for coastal habitats of the Habitats Directive are reported unfavourable-inadequate and 18% are unfavourable-bad against 29% of conservation status are unknown; the share of unfavourable assessment for coastal species of the Habitats Directive is significant with more than an quarter assessed as bad and only a moderately sized share was assessed as favourable. 83% of assessments of conservation status of species of open ocean ecosystems of the Habitats Directive are assessed as unknown; 50 % of assessments of conservation status of open ocean ecosystem habitats are assessed as unfavourable-inadequate.

CHAPTER V

OFFSHORE RENEWABLES AT THE CROSS-ROADS BETWEEN ENERGY AND ENVIRONMENTAL POLICY

REDIFINING THE ROLE OF THE ENVIRONMENTAL INTEGRATION PRINCIPLE

1 - Introduction

The present Chapter positions the offshore renewable energy (ORE) sector in the context of the environmental integration principle (hereafter: EIP) and the overarching objective of sustainable development. The *raison d'être* of this Chapter is to clarify the underlying requirements of the principle of environmental integration, as enshrined under Article 11 TFEU[1] and Article 37 of the Charter of Fundamental Right of the European Union,[2] with respect to licensing decision-making relating to ORE deployments. More specifically, this Chapter will determine whether the EIP should be understood as systematically requiring a strong application of the precautionary principle to ORE licensing under the appropriate assessment (hereafter: AA) process of the Habitats Directive. In answering this important question, the author analyses the core elements of sustainable development and its legal interactions with the EIP of Article 11 TFEU.

As far back as 2010, Vedder highlighted that 'environmental protection and sustainable development continue to occupy a prominent place in the objectives of the European

[1] Consolidated version of the Treaty on the Functioning of the European Union [2012] OJ C 326/49 (hereinafter TFEU)
[2] Charter of Fundamental Rights of the European Union [2012] O.J. C. 326/02

Union', creating an irresolvable issue regarding 'the exact weight to be given to the various objectives where they are at odds with each other'.[3] The principle of environmental integration of Article 11 TFEU constitutes a provision of general application.[4] Article 11 TFEU requires that the environmental protection requirements of the Treaties must be integrated into the definition and implementation of other EU policies and activities with a view to promoting sustainable development. This provision, which is, as observed by Krämer, probably the most important environmental provision in the whole Lisbon Treaty, 'raises considerable implementation problems for lawyers, policy-makers and administrations'.[5] Practical and legal issues associated with the implementation of this principle become particularly striking where the goals for biodiversity conservation under the Habitats Directive clash with measures aiming to deliver EU climate-energy targets.

The Habitats Directive is the epitome of environmental integration. As a horizontal environmental measure, the assessment requirements of Article 6(3) of the Habitats Directive apply across all sectors. In this respect, the EIP has played a pivotal role to support the application of a strict precautionary principle under the AA process of the Habitats Directive. Chapter IV has shown that, in the context of renewable energy, the precautionary principle prescribed by the CJEU under Article 6(3) disproportionately favours biodiversity objectives by imposing a very high standard of proof (i.e. no reasonable scientific doubt) to inform the conclusions of the AA.[6] Voigt rightly explains that trade-offs exclusively for biodiversity conservation goals are not necessarily

[3] Hans Vedder, 'The Treaty of Lisbon and European Environmental Law and Policy' (2010) 22(2) Journal of Environmental Law, 285, 288
[4] TFEU, Part I, Titre II, Article 11, C326/53
[5] Ludwig Krämer, 'Giving a voice to the environment by challenging the practice of integrating environmental requirements into other EU policies' in S. Kingston (ed.) *European Perspectives on Environmental Law and Governance* (Abingdon: Routledge, 2013), 83
[6] Case C-127/02 *Waddenzee* [2004] ECR I-07405, para.59; Case C-258/11 *Sweetman and others v. An Bord Pleanála (Sweetman)* [2013] ECLI:EU:C: 2013:220, para.40

conducive to sustainable outcomes.[7] This holds particularly true where the application of the EIP may complicate the authorisation of low-carbon energy technologies with obvious benefits for climate change mitigation.[8] The Habitats Directive cannot be divorced from other important objectives that are closely tied to the overarching objective of sustainable development. Climate change has emerged as a 'hot topic' that goes to significantly reinforce the integration between energy and environmental policy since its formal introduction in the EU legal order by the Lisbon Treaty.[9] Combating climate change is now explicitly enshrined in the Lisbon Treaty as an objective to be pursued in the sphere of the Union's policy on the environment.[10] Combating climate change is also a cross-cutting objective of sustainable development: 'tackling climate change and fostering sustainable development are two mutually reinforcing sides of the same coin: sustainable development cannot be achieved without climate action'.[11] In EU law, sustainable development is also rooted in a broad requirement for integration whereby important policy objectives formulated under the TFEU shall not be 'dealt with in isolation'.[12] Although not explicitly tied to sustainable development, Article 7 TFEU requires of the EU to ensure consistency between its policies and activities taking into account all policy objectives. Despite this, we are now in a bizarre situation where the judicial interpretation of Habitats Directive complicates the development of climate change mitigation technologies.

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[7] Christina Voigt, 'Article 11 TFEU in the light of the principle of sustainable development in international law' in B. Sjåfjell, A. Wiesbrock (eds.) *The Greening of European Business under EU Law: Taking Article 11 TFEU Seriously* (Routledge, 2015), 42

[8] Frederik Kistenkas, 'Rethinking European Nature Conservation Legislation: Towards Sustainable Development' (2013) 10 (1) Journal for European Environmental and Planning Law, 72

[9] Chad Damro, Ian Hardie, Donald MacKenzie, 'The EU and Climate Change Policy: Law, Politics and Prominence at Different Levels' (2008) 4 (3) Journal of Contemporary European Research, 179

[10] Consolidated version of the Treaty on the Functioning of the European Union [2012] OJ C 326/49 (hereinafter TFEU), Article 191(1)

[11] United Nations, The Sustainable Development Agenda. Available at <http://www.un.org/sustainabledevelopment/development-agenda/> (last accessed 14 May 2018)

[12] Sander Van Hees, 'Sustainable development in the EU: Redefining and Operationalizing the Concept' (2014) 10 (2) Utrecht Law Review, 60, 63

The respective policy objectives relating to the environment and the promotion of renewable energy are two mutually reinforcing goals under the so-called ‘sacred temple of sustainability’.[13] In order to move towards genuine sustainable development, it is essential to ensure that the Habitats Directive remains consistent with important climate-energy policy goals. Sustainable development seeks to integrate different social, economic and environmental objectives. Integration requires balance. Balance in turn, is achieved by means of proportionality.[14] One way to ensure consistency is therefore via the application of the requirements arising from the proportionality principle.

Section 2 of this Chapter will first offer a discussion on the complex relationship between EU energy and environmental policies under the legal system established by the Lisbon Treaty (section 2). Here, the author will pay a particular attention to the position of renewable energy as a cross-cutting objective of both the Union’s energy and environmental policies. Section 3 will then define the important principle of ‘integration’ in the context of sustainable development and highlight its inter-relationships with what this author will refer to as ‘Energy-Climate and Biodiversity dilemma’. In this vein, section 3 will emphasise the position of renewable energy as a critical vehicle of vertical integration in the context of ecological sustainability. Sections 4 and 5 will consider the complex legal interactions between the EIP of Article 11 TFEU and the objective of sustainable development as enshrined under Article 3 of the Treaty of the European Union (hereafter: TEU).[15] Section 5 will build on these findings to raise the important question of whether the EIP, as a constituent principle of sustainable development, necessarily infers that precedence should be given to

[13] Sanchez Galera, ‘The Integration of Energy and Environment under the paradigm of sustainability threatened by the hurdles of the internal energy market’ (2017) 26(1) European Energy and Environmental Law Review, 13
[14] Suzanne Kingston, ‘Integrating Environmental Protection and EU Competition Law: Why Competition Isn’t Special?’ (2010) 16 (6) European Law Journal, 780
[15] Consolidated version of the Treaty on the European Union [2012] OJ C 326/13

biodiversity conservation goals over objectives for renewable energy. Finally, section 6 will challenge the jurisprudence of the CJEU in light of the important proportionality principle in order to re-consider the 'sustainable' character of the judicially recognised linkage between Articles 6(3) and (4) of the Habitats Directive. This will necessarily oblige the author to determine whether ORE constitutes an 'imperative' and 'overriding' of public interest (IROPI) in the sense of Article 6(4). Overall, this Chapter will suggest a novel understanding of the EIP that is more consistent with the overarching objective of sustainable development.

2 – The complex marriage of energy and environmental policy under the Lisbon Treaty

Whilst the goal of the Habitats Directive is to promote the maintenance of biodiversity,[16] its Preamble seems to echo the tenets of sustainable development. The Preamble states that the implementation of the Directive should take into account 'economic; social and cultural requirements'[17] and 'makes a contribution to the general objective of sustainable development'.[18] The third recital of the Preamble further indicates that 'the maintenance of biodiversity may in certain cases require the maintenance, or indeed the encouragement, of human activities'.[19] In this vein, the critical question arises as to whether the authorisation criteria elaborated by the CJEU under the AA of the Habitats Directive conform with the essence of sustainable development.

The judicial interpretation of Article 6(3) of the Habitats Directive provides a concrete example of how the EIP may be operated in practice to impede the deployment of green

[16] Habitats Directive, Article 2(1), (3)
[17] Ibid.
[18] Habitats Directive, Preamble, Recital 3
[19] Ibid.

energy technologies. It clearly epitomizes a strong normative interpretation of the environmental integration principle in which precedence is exclusively given to conservation objectives.[20] Interestingly, the CJEU does not seem to believe that there is an antagonism between the goals for biodiversity conservation and the EU targets for renewable energy. For instance, in *Azienda Agro-Zootenica Franchini Sarl*,[21] the CJEU took the view that the Habitats Directive does not preclude more stringent legislation which prohibits in absolute terms the installation of all wind projects not intended for self-consumption on sites forming part of the N2000 network.[22] The applicants in the main proceedings submitted that the objectives of the energy policy, in particular the aim of developing new and renewable forms of energy, as established by Article 194(1) TFEU, should take precedence over environmental-protection objectives. The CJEU adopted a different line of reasoning. The CJEU noted that the scope of the legislation was confined to commercial wind energy developments and thereby left the possibility of exemption for wind turbines intended for self-consumption with a capacity not exceeding 20 kW. The contested legislation was not therefore, in the view of the Court, liable to jeopardise the European objective of developing new and renewable forms of energy.[23] This ruling is clearly disputable in light of the consistency principle of Article 7 TFEU (see section 5.2. below). The achievement of renewable energy policy goals requires diversification of our renewable energy portfolio and development of commercial-scale renewable energy infrastructures. It is highly unlikely that wind energy farm solely intended for self-consumption will make a meaningful contribution

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[20] Andrew Jordan and Andrea Lenschow, 'Environmental Policy Integration: A State of the Art Review' (2010) 20 Environmental Policy and Governance, 147
[21] Case C-2/10 *Azienda Agro-Zootenica Franchini Sarl* [2011] ECR I-I-6561
[22] Ibid, paras.56, 57
[23] Ibid.

to achieving the EU-wide targets to achieve 20% of renewable energy consumption by 2020[24] and 32% by 2030.[25]

Chapter IV has clearly emphasised that the Court has always maintained its stringent jurisprudence including towards onshore wind energy developments. The two cases in *Grace and Sweetman,*[26] and *People over Wind*[27] offered an invaluable opportunity for the Court to clarify its case law with respect to renewable energy developments. The present author believes that the Court may have missed an opportunity to align its jurisprudence with the overarching objective of sustainable development. From there, a crucial question arises: are the respective objectives relating to biodiversity conservation and renewable energy really at odd with each other? The answer is no. The overarching objective of sustainable development makes the respective objectives for biodiversity conservation and renewable energy indivisible under what the author will refer to as the 'energy-climate and biodiversity' dilemma.

The promotion of renewable energy is inextricably linked to the environmental policy goals in the EU legal landscape.[28] The very first recital of the 7th Environment Action Plan (hereafter EAP) states that the Union has the objective 'to become a smart, sustainable and inclusive economy by 2020 with a set of policies and actions aimed at making it a low-carbon and resource efficient community'.[29] The position of

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[24] Directive 2009/28/EC of 23 April 2009 on the provision of the use of energy from renewable energy sources (REN Directive) [2009] O.J. L. 140/16, Article 3

[25] European Commission, 'European leads the global clean energy transition: European Commission welcomes ambitious agreement on further renewable energy development in the EU' (Press Release, 14 June 2018). <http://europa.eu/rapid/press-release_STATEMENT-18-4155_en.htm> (accessed 24 August 2018)

[26] Case C-164/17 *Grace and Sweetman v. An Bord Pleanála* [2018] ECLI:EU:C: 2018:593

[27] Case C-323/17 *People Over Wind and Sweetman v. Coillte Teoranta* [2018] ECLI:EU:C: 2018:244

[28] Thea Sveen, 'The interaction between Article 192 and 194 TFEU: Renewable energy promotion with a predominant environmental purpose' in Jürgen Säcker F., Scholz L., Sveen T., (eds.) *Renewable energy law in Europe: challenges and perspectives* (Peter Lang, 2015), 157

[29] Decision No 1386/2013/EU of 20 November 2013 on a General Union Environment Action Programme to 2020 'Living well, living within the limits of our planet' [2013] OJ L 354/171

'sustainable development' and of 'low-carbon economy' within the ambit of the 7th EAP is not devoid of legal significance. The 7th EAP sets the overarching objectives to 2020 that must guide EU environmental policy. The document is remarkably characterised by an effort to integrate of energy-climate objectives and biodiversity conservation under the auspices of sustainable development. Climate change mitigation and renewable energy are at the core of the entire programme.[30] At the forefront, the 7th EAP clearly states the EAP should help achieve the environment and climate change targets of the European Union.[31] The 7th EAP further indicates that the programme 'builds on policy initiatives in the EU 2020 Strategy including the Union's climate and energy package, the Communication on a Roadmap for moving to low-carbon economy and the EU Biodiversity Roadmap'.[32] Even more so, the 7th EAP acknowledges that the 'integrated and coherent' development of environment and climate policy is necessary and must be guided by three inter-related priority objectives namely: 1) protecting, conserving and enhancing the Union's natural capital, 2) turning the Union to a resource efficient, green and low-carbon economy, 3) safeguarding the Union's citizens from environmental-related pressures and risks to health and well-being.[33] These three objectives are inter-related: 'action taken under one objective will often help to contribute to the achievement of the other objectives'.[34] In particular, 'action to mitigate climate change will increase resilience of the Union's economy and society while protecting the Union's natural capital resources'.[35]

As far back as 1998, a decade before the Lisbon Treaty came into force, the promotion of renewable energy was already perceived as a key driver of integration between

[30] See in particular recital 24, paras.22, 33, 43(a)
[31] Ibid, para.9
[32] Ibid, para.8
[33] Ibid, para.16
[34] Ibid.
[35] Ibid.

energy and environmental policy in the context of sustainable development.[36] In 1998, the EC Communication on 'Strengthening Environmental Integration within Community Energy Policy', adopted as part of the abandoned Cardiff process,[37] stressed that for 'successful integration of sustainability in our everyday life', the adoption of energy actions at the Community level are necessary to increase the share and production of cleaner energy sources in the internal market.[38] The Cardiff process was the first ground-breaking step forward in the integration of energy and environmental concerns under the discourse of sustainable development.[39]

In this regard, it is worth noting that it is within the scope of the environmental competence that the EU adopted its first legislative actions in the field of renewable energy. In accordance with the principle of conferral of power,[40] the European Union shall act only within the limits of the competences conferred upon it in the Treaties. The absence of an explicit legal basis for energy in the pre-Lisbon period has never been an insurmountable obstacle to the adoption of legislative measures on the promotion of renewable energy sources. Before the Lisbon Treaty came into force, the first Renewable Energy Directive, Directive 2001/77/EC,41 was explicitly adopted under the environmental competence of Article 175(1) EC (Article 192(1) TFEU). Under this Directive, the EU adopted a global indicative target of 12 % of gross national energy consumption from renewables by 2010 and a 22,1% indicative target of electricity

[36] European Commission, 'Strengthening Environmental Integration within Community Energy Policy' (Communication) COM (1998) 571 final, at 2
[37] This is the name of the process launched by the European Council in Cardiff in 1998 by which the Council requested different Council formations to prepare strategies and programmes in order to integrate environmental considerations into their policy areas, starting with energy, transport and agriculture. The objective was to give a practical application to the EIP stipulated under Article 6 TCE (now Article 11 TFEU). The Cardiff process created an institutional impetus for the implementation of the environmental integration principle. However, the entire procedure stopped in 2004.
[38] Ibid, at 6, 9
[39] Galera, (n13), 16-17
[40] TEU, Article 5
[41] Directive 2001/77/EC of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market [2001] OJ L 283/33

produced from renewable energy sources in total Community electricity consumption by 2010.[42] The 2001/77/EC Directive was then replaced by the 2009/28/EC Directive on the promotion of the use of energy from renewable sources (REN Directive).[43] In a similar approach, provisions imposing a legally binding target to achieve 20% of renewable energy have found a legal basis on former Article 175(1) EC.[44] On the other hand, Articles 17, 18 and 19 of the REN Directive establishing sustainability criteria for biofuels and bioliquids have been adopted on the basis of the Treaty provision on the internal market (Article 95 EC Treaty), now Article 114(1) TFEU. This strategic choice of legal basis may emphasise the predominant environmental goal behind the adoption and enforcement of legally binding targets for renewable energy.[45] It is settled case law of the CJEU that 'if a measure is designed to pursue a two-fold purpose or has a twofold component, and if one of these is identifiable as the main or predominant purpose or component, the act must be based on the legal basis required by that aim or predominant purpose'.[46] The CJEU accepts that measures that simultaneously pursue a number of objectives that are 'indissociably linked', without one being secondary and indirect in relation to the other, can be founded, exceptionally on the various corresponding legal bases.[47] The choice of Article 175(1) EC underscores the position of environmental protection as the 'centre of gravity'[48] of the 2008 REN Directive. Yet, the REN Directive predates the Lisbon Treaty. Some commentators argue in this respect that Article 175(1) may have been chosen as a legal basis by default due to the lack of

[42] Ibid, Article 2 (1) -(4)
[43] Directive 2009/28/EC of 23 April 2009 on the provision of the use of energy from renewable energy sources (Renewable Energy Directive) [2009] OJL 140/16
[44] European Commission, 'Proposal for a directive on the promotion of the use of energy from renewable sources' (Communication) COM (2008) 19 final, at 8
[45] Sveen, (n28), at 164,171
[46] Case C-336/00 *Republik Österreich and Martin Huber* [2002] ECR I-07699, para.31; Case C-490/10 *European Parliament v. Council* [2012] EU: C: 2012:525, paras. 44-45; Case C-377/12 *Commission v. Council* [2014] ECLI:EU:C: 2014:1903, para.34
[47] Case C-211/01 *Commission v. Council* [2003] ECR I-8913, para.39; Case C-411/06 *Commission v. European Parliament and Council* [2009] ECR I-07585, para.47
[48] David Langlet and Said Mahmoudi (eds.), *EU Environmental Law and Policy* (1st ed., Oxford University Press, 2016), 97

energy-specific competence in the former EC Treaty.[49] Energy policy has subsequently been formally introduced by the Lisbon Treaty as a shared competence of the European Union.[50] Article 194(1) (c) and (2) of the Lisbon Treaty explicitly confers the Union's competencies to promote renewable energy. Article 194 (1) (c) TFEU elevates the development of new and renewable forms of energy as one of the four objectives of the Union energy policy. Accordingly, the legal basis proposed by the EC for the revised REN Directive is Article 194 (2) TFEU.[51]

Despite this, the creation of the EU's energy competence turns out to be a delicate legislative exercise. Although the promotion of renewable energy has now an explicit legal basis under the Energy Title, Article 194(1) TFEU circumscribes the scope of the energy policy to 'the establishment and functioning of the internal market' and to 'the need to preserve and improve the environment'. The first paragraph of Article 194(2) further stipulates that 'without prejudice to the application of other provisions of the Treaties, the European Parliament and the Council, acting in accordance with the ordinary legislative procedure shall establish the measures necessary to achieve the objectives of the energy policy.[52] Commenting on Article 194(2), Vedder asserts that this provision still places the EU energy policy in an environmental perspective.[53] On the other hand, the reference to the establishment and functioning of the internal market seems to indicate that Member States have not vested the Union with a completely new competence in this field.[54] In this respect, Vedder contends that the specific reference to the internal market 'may only allow for a European energy policy insofar as imports and

[49] Nicolas De Sadeleer, *EU Environmental Law and the Internal Market* (Oxford University Press, 2014), 136
[50] TFEU, Article 4(2) (i)
[51] European Commission, 'Proposal for a Directive on the promotion of the use of renewable energy (recast)' (Communication) COM (2016) 767, at 6
[52] TFEU, Article 194(2)
[53] Vedder, (n3), 291
[54] Viktor Svabo, 'The EU Member States' Rights to Electricity Mix' (2016) 10(1) Masaryk University Journal of Law and Technology, 23

exports of energy are concerned'.[55] Moreover, second paragraph of Article 194(2) provides that measures adopted on the basis of Article 194(1), under the ordinary legislative procedure, 'shall not affect' a Member State's right to determine the conditions for exploiting its energy sources, its choice between different energy sources and the general structure of its energy supply. However, this limitation of the EU energy competence is without prejudice of Article 192(2) (c). By way of derogation, Article 192(2)(c) provides that measures 'significantly' affecting Member States' right to promote one source of energy over another and to decide the general structure of their energy supply can still be adopted under the environmental competence to achieve the environmental policy objectives, including that of combating climate change.[56] The derogation is subject to the special legislative procedure. The EU legislator acting under the scope of the environmental policy competence may thus still override Member States' sovereign rights to determine their energy mixes by unanimous decision of the Council. Unlike the derogation stipulated by Article 194(2), the caveat of Article 192(2)(c) only applies to measures 'significantly' affecting Member States' choice between different energy sources. In the absence of an expressly defined threshold for 'significant', the EU legislator enjoys some leeway to interfere with Member States' sovereign rights in the field of energy when acting within the framework of the environmental policy.[57] This means for example that a number of legislative measures aiming to tackle the environmental effects of global warming still fall within the environmental competence[58] of Article 192(1) or Article 192(2).[59] This statement is reinforced by the formulation 'without prejudice to the application of the other

[55] Ibid, 30

[56] TFEU, Article 192(2)

[57] Kristin Haraldsdóttir, 'The Limits of the EU Competence to Regulate Conditions for Exploitation of Energy Resources: Analysis of Article 194(2) TFEU' (2014) 23 (6) European Energy and Environmental Law Review, 208

[58] De Sadeleer, (n49), 136

[59] The question of whether renewable energy measures 'significantly' affect one of the Member State's rights referred to in Article 192(2(c) shall determine the choice of proper legal basis between Article 192(1) or 192(2).

provisions of the Treaties' under the energy competence of Article 194(2). This non-prejudice clause seems to indicate that the limitation of the EU's competence in the field of energy 'only applies to the extent to which Member States have not yet transferred competences by other Treaties provisions'.[60] In this connection, Article 194(2) can hardly be considered as *lex specialis* with respect to environmental-energy related measures adopted in the realm of the climate change policy actions.[61] As mentioned above, the Lisbon Treaty firmly establishes the objective of 'combating climate change' as an objective of the environmental policy under Article 191(1) TFEU. Pursuant to Article 191(1) TFEU, the Lisbon Treaty defines 'promoting measures at international level to deal with regional or worldwide environmental problems, and in particular combating climate change' as an objective of the environmental policy. Whilst some commentators argue that the inclusion of climate change within the ambit of EU environmental policy is a 'purely cosmetic change',[62] the present author considers that Article 191(1), when read in conjunction with second paragraph of Article 194(2) and Article 192(2)(c), may have considerable legal implications for Member States' rights to determine their national energy mixes. The energy competence of Article 194(2) TFEU, when read in conjunction with the provisions of Article 192(2), gives the EU some considerable leeway to pave the way towards further energy transition in the scope of the environmental policy.

The decision of the General Court in *Republic of Poland v Commission*[63] illustrates this sensitive issue. In this case, Poland brought an action for annulment of the Decision 2011/278/EU of the European Commission concerning the rules for harmonised free allocation of emission allowances under the EU Emissions Trading Scheme. The

[60] Svabo, (2016), (n54), p.31
[61] Christian Hey, Christian Calliess, 'Multilevel Energy Policy in the EU: Paving the Way for Renewables?' (2013) 10 (2) European Journal for Environmental and Planning Law, 87
[62] Vedder, (n3) 290
[63] Case T- 370/11 *Republic of Poland v. Commission* [2013] ECLI:EU: T: 2013:113

Republic of Poland argued that this decision infringed the prohibition of Article 194(2) TFEU, read in conjunction with Article 192(2) (c), insofar as the contested decision affected Member States' right to decide upon different energy sources and the general structure of their energy supply.[64] By focusing on natural gas as a reference fuel to define emission allowance benchmarks in the greenhouse gas emissions trading scheme, the Commission would have arbitrarily favoured Member States predominantly using natural gas compared to Member States that are heavily based on coal.[65] Interestingly, the contested decision was based on the former Emission Trading Directive[66] adopted under the environmental competence of Article 192(1). The General Court of the CJEU adopted a striking decision by holding that the prohibition on interfering with Member States' rights in the field of energy under Article 194(2) cannot be read as a general prohibition that is applicable to EU actions taken within the framework of the environmental policy.[67] According to the Court, Article 194 TFEU is a general provision which relates solely to the energy sector and, consequently, delineates a sectoral competence.

More recently, the Republic of Poland brought another action challenging the legal basis for Decision 2015/1814 of the European Parliament and of the Council concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading system.[68] This decision was similarly adopted in accordance with the ordinary legislative procedure on the basis of Article 192(1). The Republic of Poland asserted that the increase in the price of greenhouse gas emission allowances envisaged by the decision would directly affect Member States' choice between different

[64] Ibid, para. 10
[65] Ibid, paras. 10, 24
[66] Directive 2003/87/EC of13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC [2003] OJ L 275/32
[67] Case T- 370/11 *Republic of Poland v. Commission*, para.17
[68] Decision 2015/1814 of the European Parliament and of the Council of 6 October 2015 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme and amending Directive 2003/87/EC [2015] OJ L 264/01

technologies for future investments and as such, the contested decision should have been adopted in accordance with the special legislative procedure.[69] In these proceedings, the European Commission acknowledged that the increase in the price of allowances was intended to encourage fuel switching and to discourage investment in coal-fired plants.[70] The CJEU held that as a derogation rule, the special legislative procedure of Article 192(2) (c) must be interpreted restrictively.[71] The Court pointed out that the merit of the legal basis must be considered in light of the aim and content of the contested decision.[72] In this respect, the Court noted that the aim and content of the decision was not to affect a Member State's choice between different energy sources and the general structure of its energy mix. Rather, the contested decision aimed at correcting the weaknesses of the Emissions Trading System that could prevent the scheme from fulfilling its environmental objective of reducing greenhouse gas emissions.[73] The increase in the price of allowance was only an indirect consequence of the contested decision and therefore, the EU legislature was entitled to base the decision on Article 192(1) TFEU.

From there, it is remarkable to note how the EU legislator may have reserved the right to direct Member States' choice between different energy sources when acting under the scope of the environmental competence of Article 192(2).[74] Article 192(2) clearly appears as a pivotal competence for adopting measures aimed at promoting the use of renewable energy. Some scholars have gone so far as to contend that 'such shared competence has some traits of an exclusive competence' where the environmental policy goal related to climate change closely intermingles with the energy

[69] Case C-5/16 *Republic of Poland v European Parliament and Council* [2018] ECLI:EU:C: 2018:483
[70] Ibid, Opinion AG Mengozzi, 30 November 2017, para.11
[71] *Republic of Poland*, para. 44
[72] Ibid, paras.47-48
[73] Ibid, paras.63-68
[74] Marjan Peeters, 'Governing towards renewable energy in the EU: Competences, Instruments and procedures' (2014) 21 (1) Maastricht Journal of European and Comparative Law, 43

competence.[75] Sveen also rightly observes that as environmental and energy legislation become 'more detailed and intertwined' under the Lisbon Treaty, 'it is hard to define where the European Union has not pre-empted Member States action' in the field of energy policy.[76] AG General Bot made a striking observation in this regard:

> 'Whilst it is clear from the second subparagraph of Article 194(2) TFEU that the European Union's energy policy is intended to preserve freedom of choice as regards national energy mixes, without prejudice to Article 192(2)(c) TFEU, such energy policy decisions may nevertheless be affected by measures adopted in the context of its environmental policy, as is demonstrated by Directive 2009/28 itself, which, by laying down mandatory targets for green energy consumption in each Member State, necessarily exerts an influence on the composition of their respective energy mixes'.[77]

Against this, legal scholars have claimed that 'energy measures aiming at preventing climate change should be adopted by virtue of both Articles 192(1) and Article 194 (2) TFEU'.[78] Despite discussions during the co-decision procedure to include both Article 191(1) and Article 194(2) as an appropriate legal basis for the revised REN Directive,[79] the choice of Article 194(2) as a single legal basis has been upheld.[80] The choice of Article 194(2) may be justified by the fact that the revised REN Directive does not assign mandatory national targets. National mandatory targets will be abandoned for the period 2020-2030 and replaced by an EU-level target to be achieved collectively through individual Member States' contributions, without preventing Member States

[75] J.P. Jacqué, *Droit Institutionnel de l'Union Européenne* (7th édition. Cours Dalloz 2012), p.156
[76] Sveen, (n28), 162
[77] Case C-573/12 *Ålands Vindkraft AB* [2014] ECLI: EU: C:2037, Opinion AG Bot, 28 January 2014, para.104
[78] De Sadeleer, (n49), 136
[79] Committee on Legal Affairs, 'Opinion on the legal basis of the proposal for a directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources (recast)' COM (2016)0767 – C8-0500/2016 – 2016/0382(COD)). A8-0392/2017
[80] European Commission, (n51), at 6

from setting their own, including more ambitious national targets.[81] This new approach to governance in the field of energy for 2030 significantly increases flexibility for Member States to decide on the structure and composition of their energy mixes. The EU legislator may have excluded the use of the environmental competence of Article 192(1) as a relevant legal basis to circumvent the prohibition of interfering with Member States' rights to determine the structure and composition of their energy mixes.

Notwithstanding the existence of two distinct legal bases for the promotion of renewable energy and environment, the CJEU has been particularly active in increasing the value of environmental protection goals as a legitimate ground to promote the use of renewable energy sources. In particular, the CJEU has continuously relied upon the EIP to justify restrictions to the operation of the single market with a view of promoting the use of renewable energy. The promotion of renewable energy has been explicitly recognised by the Court as sufficiently important to justify restrictions to one of the fundamental rules of the single market (see section 6 below).[82]

In line with the spirit of the 7th EAP, the 'energy-climate versus biodiversity' dilemma should be a driver for strengthened integration between renewable energy and biodiversity conservation under the auspices of sustainable development. As mentioned above, the objective of sustainable development has played a pivotal role to integrate climate-related energy objectives and environmental considerations within the ambit of the environmental policy. As rightly observed by Galera, 'here is where the "EU constitutional concerns" firmly established by the Lisbon Treaty should play an important role if we want to shape the future of our energy and environmental policy

[81] Ibid, 2

[82] Case C-573/12 *Ålands Vindkraft v. Energimyndigheten* [2014] EU: C: 2014:2037, para.78; Joined Cases C-204/12 and C-208/12 *Essent Belgium NV v. Vlaamse Reguleringsinstantie voor de Elektriciteits* [2014] ECLI: EU: C: 2014:2192, para.91

under the "sustainability" paradigm'.[83] Promotion of renewable energy is at the core of sustainable development.

3- Sustainable development and integration in the context of the 'Energy-Climate versus Biodiversity' dilemma

3.1. Sustainable development and 'integration' in International law

Sustainable development is best defined in the Bruntland Report as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs'.[84] In the framework of the United Nations, sustainable development concerns the 'continuing need to ensure a balance between economic development, social development and environmental protection as interdependent and mutually reinforcing pillars of sustainable development'.[85]

Legal scholars have often struggled to ascertain the legal nature of this concept. Lowe for example, considers that sustainable development 'is inherently incapable of having the status [...] of a rule of law addressed to States'.[86] Indeed as emphasised by Barral, the flexible formulations relating to sustainable development in international law mean that evidence of *opinio juris* and State practice - that characterise customary international rules of law[87] – cannot be ascertained.[88] If sustainable development in itself cannot be regarded as a rule of customary law, Barral sees in this concept the

[83] Galera, (n13), 14
[84] World Commission on Environment and Development (WCED), *Our Common Future* (Oxford University Press 1987), para.1
[85] World Summit on Sustainable Development, *Johannesburg Declaration on Sustainable Development* A/CONF.199/20, 4 September 2002
[86] Vaughan Lowe, 'Sustainable Development and Unsustainable Arguments', in A. Boyle and D. Freestone (eds), *International Law and Sustainable Development: Past Achievements and Future Challenges* (1st edn, Oxford University Press, 1999), 24
[87] Statute of the International Court of Justice, Article 38(1) (b)
[88] Virginie Barral, 'Sustainable Development in International Law: Nature and Evolution of an Evolutive Legal Norm' (2012) 23 (2) European Journal of International Law, 377, 386

existence of a general practice accepted by law.[89] Voigt goes further to consider that sustainable development is a general principle of law.[90] According to her, classifying sustainable development as a general law principle is 'legitimised by its widespread use in many national legal systems and in international law, signifying a common conscience and the jurisprudence of international courts and tribunals, as well as by its moral necessity.'[91] In a related publication, Voigt argues that the normative force, broad scope and support of sustainable development in the international community are indicative of its principled character and make it difficult to argue otherwise.[92]

Although sustainable development has proved to be a notion 'defying legal classification in international law',[93] there is now general agreement whereby its normative content is defined by the principle of integration.[94] A noteworthy statement of the International Law Association Committee indicates that 'integration is pivotal to the promotion of sustainable development: it is the principle that both brings together the many challenges confronting the international community and at the same time, provides the most realistic chance of their solutions'.[95] 'Integration' would 'form the backbone of sustainable development'.[96]

The principle integration in the context of sustainable development involves two dimensions. The 'horizontal' dimension of sustainable development is intrinsically

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[89] Ibid, 388
[90] Voigt, (2015), 'Article 11 TFEU in the light of the principle of sustainable development', (n7) 32
[91] Ibid.
[92] Christina Voigt, *Sustainable development as a Principle of International Law: Resolving Conflicts between Climate Measures and WTO Law* (vol.2, Leiden: Martinus Nijhoff Publisher, 2008), 186
[93] Barral, (n88), 377
[94] Owen McIntyre, 'The Principle of integration in International law relating to sustainable development. Sobering lessons for European Union Law' in Westra L., Taylor P., Michelot A., (eds). *Confronting Ecological and Economic Collapse* (Routledge, 2013), 114
[95] International Law Association, Committee on International Law on Sustainable Development Seventy-First Report (Berlin Conference 2004), 13
[96] UN Commission on Sustainable Development, Report of the CSD Expert Group on Identification of Principles of International Law for Sustainable Development, (Geneva, 26-28 September 1995), Paper No3, para.15

linked to the equitable balancing of economic, social and environmental protection imperatives.[97] The vertical dimension of sustainable development, as enunciated by the Brundtland Commission, involves what Barral refers to as the twin conceptions of intra-generational equity (within the same generation) and 'inter-generational equity (between generations).[98] Inter-generational equity or inter-generational justice[99] calls for the equitable development opportunity in the present and sustained development opportunity for the future.[100]

In international law, the principle of integration in the context of sustainable development first arose in the United Nations Stockholm Declaration on the Human Environment.[101] Although 'sustainable development' was not initially mentioned under the Stockholm Declaration, the uneasy need to 'integrate' environmental protection and economic development was already clearly established under a number of Principles of the Stockholm Declaration. As far back as 1972, Principle 4 of the UN Conference on Human Development stated that 'Man has a special responsibility to safeguard and wisely manage the heritage of wildlife and its habitat. [...] Nature conservation, including wildlife, must therefore receive importance in planning for economic development'.[102] In a similar approach, the vertical process of integration, i.e. the so-called 'inter-generational' dimension of sustainable development, was clearly endorsed in Principle 13, which provides that 'in order to achieve a more rational management of resources and thus to improve the environment, States should adopt an integrated and coordinated approach to their development planning so as to ensure that development is

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[97] Voigt, (n7), 33
[98] Barral, (n88), 380
[99] Herwig Unnerstall, 'Sustainable development as a criterion for the interpretation of Article 6 of the Habitats Directive' (2006) 16 (2) Environmental Policy and Governance, 73
[100] Barral, (n88), 381
[101] United Nations Conference on the Human Environment, Declaration on the Human Environment, U.N. Doc. A/CONF.48/14 Corr. 1 (June 16, 1972) [Stockholm Declaration], Principles 4, 13, 15–20.
[102] Ibid, Principle 4

compatible with the need protect and improve the environment for the benefit of their population'.[103]

In 1987 the 'integrational' aspect of sustainable development was clearly recognised in soft international law. In that year, the World Commission on Environment and Development issued the report 'Our Common Future',[104] also known as the Bruntland Report', which for the first time stressed the need to 'integrate' economic development, environment and social development in policy and decision-making.[105] In a similar approach, 'inter-generational equity' or 'inter-generational justice'[106] is reiterated as the core principle of sustainable development under Principle 3 of the Rio Declaration.[107] Inter-generational equity calls for development choices that equitably meet the developmental and environmental needs of present and future generations.[108] The horizontal integration of sustainable development is clearly endorsed by Principle 4 of the Rio Declaration whereby, in order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.

Sustainable development rapidly moved towards a normative principle after its introduction among the legally-binding principles of the United Nations Framework Convention on Climate Change (UNFCCC).[109] The UNFCCC is an important milestone in that it fully recognises the imperative of climate change mitigation in the context

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[103] Ibid, Principle 13
[104] UN World Commission on Environment and Development (WCED), *Our common future* (Oxford, 1987)
[105] Luis A. Avilés, 'Sustainable Development and Environmental Legal Protection in the European Union: A Model for Mexican Court to Follow?' (2014) 6(2) Mexican Law Review, 251
[106] Unnerstall, (n99), 74
[107] Declaration on Environment and Development (UNGA Doc. A/CONF.151/16/Rev.1 1992, 14 June 1992)
[108] General Assembly, Report of the United Nation Conference on Environment and Development, U.N. Doc. A/CONF. 151/26 (June 13, 1992); 31 I.L.M. 874 (1992)
[109] United Nations Framework Convention on Climate Change (adopted 9 May 1992, entered into force 21 March 1994) 1771 UNTS 107 (UNFCC)

sustainable development. The framework Convention also places the concept of inter-generational equity into a climate justice approach. Article 3(1) of the UNFCC provides that Parties should protect the climate system for the benefit of present and future generations of humankind on the basis of equity and in accordance with their common but differentiated responsibilities. Article 3(4) further states that the Parties have a right to, and should, promote sustainable development. To do so, 'policies and measures to protect the climate system against human-induced change should be integrated with national development programmes, taking into account that economic development is essential for adopting measures to address climate change'.

The element of inter-generational equity deserves closer consideration. The Intergovernmental Panel on Climate Change (IPPC) states that 'equity between generations underlines the very notion of sustainable development'.[110] Inter-generational equity is closely connected to the notion of ecological sustainability, which presupposes the existence of 'ecological functions that are indispensable for a durable and equitable human society'.[111] 'Inter-generational equity' has a direct bearing on what Gaines refers to as the 'energy-climate trilemma' or 'energy trilemma'.[112] 'Energy trilemma' is an indicator used by the World Energy Council to reflect the complex balance between the three imperatives of energy security, energy equity and environmental safety.[113] In the words of Gaines, the challenge of resolving the trilemma revolves around a single question: How can the world produce more energy to meet rising demand, at a cost affordable to all, without causing catastrophic climate change in

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[110] Fleurbaey and others, 'Sustainable Development and Equity' in: IPPC, *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge University Press,2014), 294

[111] Voigt, (n7), 41

[112] Sandy Gaines, 'The Energy Revolution as Sustainable Development' in Squintani, L., Vedder, H.H.B. (ed.), *Sustainable energy united in diversity. Challenges and approaches in energy transition in the European Union* (European Environmental Law Forum, Book series vol. 1, 2014), 7

[113] World Energy Council (2016). World Energy Trilemma Report 2016: Defining Measures to Accelerate the Energy Transition. <https://www.worldenergy.org/publications/2016/world-energy-trilemma-2016-defining-measures-to-accelerate-the-energy-transition/> (12 March 2018), at 12

the process?[114] It is commonly asserted that the so-called 'energy-climate trilemma' is 'a problem of sustainable development'.[115] The issue with this notion (energy-climate trilemma) is that it fails to reflect the core element of ecological sustainability, which is a central component of genuine sustainable development. This author therefore prefers the term 'energy-climate-biodiversity' dilemma to better emphasise the complex relationships between ecological sustainability and the promotion of renewable energy in the context of sustainable development.

3.2. Ecological sustainability as a backbone of 'integration' between climate-energy objectives and biodiversity conservation

Ecological sustainability is the 'ecological core' of sustainable development.[116] The concept of ecological sustainability derives from the purpose of sustainable development which typically requires that 'ecological functions exist that are indispensable for a durable and equitable human society'.[117] Ecological sustainability is met where ecological systems are sufficiently resilient to sustain important ecosystem functions and processes supporting plants, animals and large populations of human.[118] In this respect, ecological sustainability determines the 'safe operating space'[119] within which human activities can operate without exceeding critical ecological limits of ecosystem functioning. Beyond these limits (or thresholds), ecosystems may no longer sustain future generation and development is no longer sustainable. Without giving

[114] Gaines, (n112), 7
[115] Ibid, 9
[116] Klaus Bosselmann, 'Grounding the rule of law', in Voigt C., (ed.) *Rule of Law for Nature: New Dimensions and Ideas in Environmental Law* (Cambridge University Press, 2013), 75, 89
[117] Christina Voigt, 'The principle of sustainable development: Integration and ecological integrity' in Voigt C., (ed.) *Rule of Law for Nature: New Dimensions and Ideas in Environmental Law* (Cambridge University Press, 2013), 146, 151
[118] Ibid.
[119] Johan Rockström and others, 'Planetary Boundaries: Exploring the Safe Operating Space for Humanity' (2009) 14(2) Ecology and Society, 32

absolute priority to ecological interest, ecological sustainability sets the ecological limits within which the balancing exercise mandated by sustainable development between economic, social and ecological interests must take place. Sustainable development is a broader objective that demands that current human development does not exceed ecological limits that are necessary to support life and equitable development of future human generations.[120]

Climate change is inherently an intergenerational problem with 'serious implications for equity between present and future generations'.[121] In linking human well-being and natural ecosystems, the framework of the Millennium Ecosystem Assessment (MEA)[122] has crystallised the idea that human development is vitally dependent on healthy ecosystems for the provision of ecosystem services.[123] Ecosystem services are the benefits people receive from natural ecosystems.[124] Natural ecosystems contribute directly to human well-being, through provisioning services (food, raw materials), cultural services (recreation, landscape aesthetic), regulating services (flood protection, carbon sequestration, waste assimilation); and supporting services (e.g. nutrient cycling, photosynthesis).[125] Anthropogenic climate change is a major driver of biodiversity loss and changes in ecosystem services. The MEA stresses that biodiversity loss as a result of unmitigated climate change will inevitably lead to declining ecosystem services and cause people to experience increased poverty in some social groups.[126] Climate change is projected to exacerbate the loss of biodiversity and increase the risk of extinction for

[120] WCED, *Our Common Future* (1987), paras.9, 10; Christina Voigt, (2013), Op. cit., (n117), p.156
[121] Brown Weiss, 'Climate Change, Intergenerational Equity, and International Law' (2008) 9 Vermont Journal of Environmental Law, 615
[122] Millennium Ecosystem Assessment, *Ecosystems and Human Well-Being: A Framework for Assessment* (Island Press, Washington D.C., 2003), at 49
[123] Ibid.
[124] Millennium Ecosystem Assessment, *Ecosystems and Human Well-Being: Biodiversity Synthesis,* (Island Press, Washington D.C., 2005)
[125] Millennium Ecosystem Assessment, (2003), (n122), at 53-60
[126] Millennium Ecosystem Assessment, (2005), (n124), at 5

many species, especially those already at risk'.[127] Increasing CO_2 emissions from fossil fuel extraction and combustion are a significant driver of loss of marine biodiversity.[128] Ocean acidification and increased ocean temperatures are direct consequences of unabated CO_2 emissions.[129] Scientists have consistently raised awareness of the adverse biological impacts of ocean acidification on survival, growth, reproduction and other functions of marine species.[130] According to the IPCC, approximately 10% of species assessed so far will be at an increasingly higher risk of extinction for every 1°C rise in global mean temperature.[131] With respect to marine habitats, the cumulative effect of temperature rise and increased CO_2 levels, 'primarily impact the integrity of marine habitats by changing their abiotic conditions'.[132] Changes in abiotic conditions lead to deterioration of their quality and eventually to the loss of key N2000 habitats types and protected species.[133] As discussed in Chapter IV above, 35% of species protected by the Habitats and Birds Directives have been identified as being 'very highly' and 'extremely highly' vulnerable to climate change effects.[134] Of the assessed species with an unfavourable-bad conservation status, 60% have been designated as being high to critical vulnerability from climate change.[135]

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[127] Ibid, at 10

[128] Andrew S. Brierley, Michael J. Kingsford, 'Impacts of Climate Change on Marine Organisms and Ecosystems' (2009) 19(14) Current Biology, 602

[129] Miyoko Sakashita, 'Curbing CO2 Pollution: using Existing Law to Address Ocean Acidification' in Abate R.S., (ed.) *Climate Change Impact on Ocean and Coastal Law: US and International Perspective* (Oxford University Press, 2015), 46

[130] Kristy Kroeker, and others, 'Impact of Ocean acidification on Marine Organisms: Quantifying Sensitivities and Interaction with Warming (2013) 19 Global Change Biology, 188

[131] IPCC, (2007). Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland, 104pp.

[132] European Commission 'Guidelines on climate change and Natura 2000'. (March 2013). <http://ec.europa.eu/environment/nature/climatechange/index_en.htm>, (20 March 2017), at 22

[133] Ibid

[134] Claire Vos, and others, 'Supplement: Managing Climate Change for the Natura 2000 Network – Assessment of the Vulnerability of Natura 2000 species and habitats for Climate Change: Species and Habitats Type Most at Risk' (ENV B.3/SER/2010/0015r) (Alterra- Wageningen US 2012), at 31

[135] Ibid.

ORE projects come with indirect benefits for biodiversity in that they contribute to reducing CO_2 emissions generated by fossil combustion, the primary cause of climate change.[136] This statement must be advanced with caution as the long-term benefits that ORE may create for biodiversity through the abatement of CO_2 emissions are highly difficult to measure or quantify.[137] The Conference of the Parties to the Convention on the Conservation of Migratory Species and Wild Animals[138] has recently warned against the impacts on migratory species of mitigation measures aimed at reducing the effects of climate change: 'measures aimed at curbing climate change, such as renewable energy are thought to have most immediate negative impacts on migratory species today compared to the direct impact of climate change'.[139] Quantifying the trade-offs between local significant impacts of renewable energy projects and their long-term conservation benefits to biodiversity is highly difficult to measure.[140] Nevertheless, no one can dispute that renewable energy installations generate significantly lower greenhouse gas emissions per unit of energy. Recent figures indicate that in 2015, wind energy avoided 218 million tonnes of CO_2 in the EU.[141] Some more recent figures further show that at the end of 2016, climate change benefits in terms of reduced CO_2 (million tons/years) associated with wind energy production have been estimated at 9.9 million tons (772 g/kWh) in Denmark and 52.5 million tons in Germany.[142] In the United Kingdom, offshore wind farms enabled a reduction of 8,6 million tonnes of CO_2 emissions at the

[136] Andrea Santangeli and others, 'Global change synergies and trade-offs between renewable energy and biodiversity' (2016) 8(5) Bioenergy, 941

[137] Ralph Frins, Hendrik Schoukens, (2014). 'Balancing wind energy and nature protection: from policy conflicts towards genuine sustainable development' in Squintani, L., Vedder, H.H.B. (ed.), *Sustainable energy united in diversity. Challenges and approaches in energy transition in the European Union* (Leipzig, European Environmental Law Forum, 2014), 85

[138] Convention on the Conservation of Migratory Species and Wild Animals (Adopted 23 June 1979, entered into force 1 November 1983) 1651 UNTS 333

[139] Conference of the Parties to the Convention on the Conservation of Migratory Species and Wild Animals, Climate Change and Migratory Species (UNEP/CMS/COP12/Doc.24.4.2), Manila, Philippines, 23 - 28 October 2017

[140] Frins and Schoukens, (n137), 95

[141] Wind Europe, (2015) 'Wind Energy Today'. <https://windeurope.org/about-wind/wind-energy-today/> (accessed 10 August 2017)

[142] International Energy Agency, (2016), EIA Wind TCP 2016 Annual Report (September 2017). <https://community.ieawind.org/publications/ar> (accessed 12 February 2018), at 16

end of 2016.[143] In addition, power generated by ocean energy alone may permit a reduction of 276 million tonnes of CO_2 annually by 2050.[144]

Renewable energy is an important element of integration in the context of climate change mitigation and ecological sustainability. The need for renewable energy is well represented under the Sustainable Development Goals of the 2030 Agenda for Sustainable Development.[145] Renewable energy occupies a significant position under the Sustainable Development Goals 7, 13 and 14 which respectively aim to 'ensure access to affordable, reliable, sustainable and modern energy for all' (Goal 7), 'take urgent action to combat climate change and its impacts' (Goal 13), and strengthen the resilience of marine and coastal ecosystems while also minimising ocean acidification (Goal 14).[146] These goals, described as indivisible and integrated, will contribute to meeting relevant Aichi Targets, in particular Target 5 (i.e. habitats loss halved or reduced) and Target 10 (i.e. ecosystem vulnerable to climate change) aiming at reducing the direct pressures on biodiversity.

Biodiversity protection also has an important role to play in mitigating the effects of climate change. N2000 sites are important nature-based solutions to slow down threats associated with climate change. N2000 sites contribute to building resilient ecosystems capable of coping with the effects of climate change and provide a number of ecosystem services.[147] For example, marine protected areas help protect marine habitats that sequester and store large amounts of carbon and prevent the release of carbon by

[143] The Crown Estate, (2017). Offshore Wind Operational Report - January-December 2016. Available at <https://www.thecrownestate.co.uk/media/1050888/operationalwindreport2017_final.pdf> (accessed 22 February 2018), at 1
[144] Ocean Energy Forum, (2016). Ocean Energy Strategy Roadmap 2016, building ocean energy for Europe. <https://webgate.ec.europa.eu/maritimeforum/frontpage/1036> (accessed 12 March 2017), 14
[145] UNGA Res. A/RES/70/1 (2015) GAOR 70th Session Supp16, 19, 23
[146] Ibid.
[147] European Commission, (n132), at 15

averting anthropogenic perturbations of sediments.[148] By reducing anthropogenic pressures, marine reserves enable species to recover in abundance, biomass and diversity. Increased genetic diversity and biomass in turns improve ecosystem resilience and provide raw materials for adaptation to climate change.[149] Ecological sustainability is therefore dependent upon the outcomes of both the objectives for biodiversity conservation and renewable energy. Climate change mitigation and adaptation cannot be achieved without biodiversity protection. The EU Biodiversity Strategy recognises that biodiversity loss cannot be averted without tackling the effects of climate change.[150] It is therefore important to equally pursue and maximise these two related objectives in the EU policy framework.

The 7th Environmental Action programme (EAP)[151] places an important onus on integrating climate-related energy objectives and biodiversity goals. The Programme states that 'ecosystem-based approaches to climate change mitigation and adaptation, which also benefit biodiversity and the provision of other ecosystem services, should be used more extensively as part of the Union's climate change policy, while other environmental objectives such as biodiversity conservation and the protection of soil and water should be fully taken into account in decisions relating to renewable energy'.[152] Upon closer examination, the 7th EAP notably recognises that actions to mitigate and adapt to climate change will increase the resilience of the Union's economy and society, while stimulating innovation and protecting the Union's natural resources.[153] Accordingly, the 7th EAP may be read as a reciprocal commitment to

[148] Callum M. Roberts and others, 'Marine reserves can mitigate and promote adaptation to climate change' (2017) 114 (24) PNAS, 6167
[149] Ibid.
[150] European Commission, 'The EU Biodiversity Strategy to 2020' (Communication) COM (2011) 244 final, at 1
[151] Decision No 1386/2013/EU of 20 November 2013 on a General Union Environment Action Programme to 2020 'Living well, living within the limits of our planet' [2013] OJ L 354/171
[152] Ibid, para. 22
[153] Ibid, para. 16

integration between the EU objectives for climate and energy and biodiversity protection.

A similar commitment to integrate climate-energy and biodiversity goals is also noticeable, although to a significantly lesser extent in the EU Strategy for Sustainable Development (EU SDS)[154] and the more recent 'Europe 2020' Strategy for smart, sustainable and inclusive growth.[155] The EU SDS sets the objectives and key principles for sustainable policy-making. Although the EU SDS has been criticised for being overly economically-oriented,[156] the EU SDS indirectly encourages integration of climate-energy and biodiversity goals by re-asserting a series of operational objectives for 'climate change and clean energy' under which the Strategy clearly asserts that the energy policy should be consistent with the objective of environmental sustainability insofar as 'energy policy is crucial to 'tackle the challenge of climate change'.[157] Unfortunately, the Europe 2020 strategy does not put forward such a reciprocal commitment to integration. It meaningfully incorporates the EU's commitments on climate/energy targets but does not refer to the other important non-climate related objectives of the environmental policy. This 'weak embedding of environmental objectives'[158] in what is now the main policy instrument for sustainable development in the EU is highly regrettable in that it elides one of the fundamental pillars of sustainable development: biodiversity protection.

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[154] European Commission, 'Mainstreaming sustainable development into EU policies: 2009 Review of the European Union Strategy for Sustainable Development' (Communication) COM (2009) 400 Final.

[155] European Commission, 'Europe 2020: A strategy for smart, sustainable and inclusive growth' (Communication) COM (2010) 2020 final.

[156] Maria Lee, *EU Environmental Law and Decision-Making* (2nd edn, vol.43, Modern studies in European law, Hart Publishing, 2014), 63-64

[157] European Council, Review of the EU Sustainable Development Strategy (DOC 10917/06), at 7-8

[158] Lee, (n156), 64

4- The nexus between sustainable development and environmental integration in EU law

The environmental integration principle (EIP), as enshrined under Article 11 TFEU, 'calls for a permanent, continuous "greening" of all Union policies'.[159] The principle introduces a requirement whereby environmental protection requirements must be integrated into the definition and implementation of other EU policies and activities with a view to promoting sustainable development. As noted above, 'environmental protection and sustainable development continue to occupy a prominent place in the objectives of the EU' creating an irresolvable issue regarding the exact weight to be given to the various objectives where they are at odds with each other'.[160]

The Brundtland definition of sustainable development has been endorsed by the European Council.[161] Sustainable development is now enshrined under Article 3(3) of Treaty on the European Union as an overarching goal governing all the Union's policies and activities.[162] Sustainable development has remained normatively indeterminate in the EU legal framework. Sustainable development was first introduced into the EU treaties by the Treaty of Amsterdam[163] amending the Treaty of Rome (EC Treaty).[164] In EU Law, sustainable development has been traditionally associated with the EIP since the incorporation of the environmental integration clause into Article 130r (2.2) of the European Economic Community Treaty[165] by the 1986 Single European Act.[166] Article

[159] Ludwig Krämer, *EU Environmental Law* (7th ed., Sweet & Maxwell, 2011), 20
[160] Vedder, (n3), 288
[161] European Council, (2001). Presidency conclusions of the Gotebörg European Council, 15 and 16 June 2001, SN 200/1/01
[162] Council of the European Union, 'Review of the EU Sustainable Development Strategy – Renewed Strategy', 10917/06, 26 June 2016, p.2
[163] Treaty of Amsterdam Amending the Treaty on European Union, the Treaties Establishing the European Communities and Certain Related Acts, 1997 O.J. C 340/1, article 12 [hereinafter Treaty of Amsterdam]
[164] Treaty Establishing the European Economic Community, Mar. 25, 1957, 298 U.N.T.S. 11 (hereinafter EEC Treaty)
[165] EEC Treaty, 298 U.N.T.S. 11, amended by SEA, Article 130r (2), 1987 O.J. L 169/1

130r (2.2) required that ‘environmental protection requirements shall be a component of the Community’s other policies’.[167] This provision was then reinforced by the 1992 Maastricht Treaty[168] which turned the environmental integration provision to turn it into an obligation.[169] It is not necessary to debate at length on the origins of the EIP.[170] However, it is worth noting that the most definitive contribution to the EIP, in relation to sustainable development, was brought by the Treaty of Amsterdam. The Treaty of Amsterdam has extended the application of the EIP to all EU policy areas referred to in Article 3 of the EC Treaty[171] and promoted it as a general principle of EU Law.[172] More particularly, Article 6 of the revised EC Treaty clarified the remit of application of the EIP and made it instrumental to the objective of sustainable development.[173] Article 6 of the EC Treaty provided that:

> ‘Environmental protection requirements must be integrated into the definition and implementation of the Community policies and activities referred to in Article 3, in particular with a view to promoting sustainable development’.[174]

What is more, the Treaty of Amsterdam elevated the concept of sustainable development to the status of ‘objective’ to be pursued by the EU.[175] Sustainable

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[166] Single European Act, 1987 O.J. L 169/1, [1987] 2 C.M.L.R. 741, corrected by 1987 O.J. L 304/46
[167] EEC Treaty, Article 130r (2.2)
[168] Consolidated Version of the Treaty Establishing the European Community, Article 130r (2) [1992] O.J. C 224/1 [Maastricht]
[169] Julian Nowag, ‘The Sky is the limit: On the drafting of Article 11 TFEU’s first integration obligation and its intended reach’ in Sjåfjell B., Wiesbrock A., (eds*), The Greening of European Business under EU Law: Taking Article 11 TFEU Seriously* (Routledge, 2015), 15, 20
[170] For more details on the evolution of sustainable development in EU Law: De Sadeleer N., ‘Sustainable development in EU Law: Still a long way to go’ (2015) 6 (1) Jindal Global Law Review, 39
[171] Tobias Schumacher, ‘The environmental integration clause in Article 6 of the EU Treaty: prioritising environmental protection’ (2001) 3 Environmental Law Review, 23
[172] Jan H. Jans, ‘Stop the Integration Principle?’ (2011) 33 (5) Fordham International Law Journal, 1533
[173] McIntyre, (n94), 108
[174] Consolidated Version of the Treaty Establishing the European Community, Article 6 [1997] O.J. C 340/173, at 183
[175] EC Treaty 1997 Consolidated Version, Article 2, 1997 O.J. C 340, at 181

development is now formally recognised as a primary objective of the European Union under the Lisbon Treaty which, in simple terms, provides that:

> 'The Union shall […] work for the sustainable development of Europe, based on balanced economic growth, a highly competitive social market economy, aiming at full employment and social progress, and a high level of protection and improvement of the quality of the environment'.[176]

This definition encapsulates the three pillars of sustainable development (i.e. environmental, social and economic).[177] Article 3(3) TEU has been interpreted as placing these three objectives on an equal footing.[178] It follows from this that the overarching goal of sustainable development would be based on the reconciliation and not on the opposition of these imperatives.[179] De Sadeleer notes in this respect that 'since no hierarchy is provided between these different pillars, they constitute an inseparable whole and cannot be interpreted in isolation from one another'.[180]

Article 3(3) must nonetheless be read in combination with the EIP of Article 11 TFEU (previous Article 130r 2.2, EEC Treaty). For some authors, Article 11 TFEU would formalise the environmental pillar of sustainable development (see below).[181] Article 11 TFEU reproduces, almost identically, the wording of Article 6 of the revised EC Treaty, as follows:

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[176] TEU, Article 3(3)
[177] Nicolas De Sadeleer, 'Sustainable development in EU Law: Still a long way to go' (2015) 6 (1) Jindal Global Law Review, 39, 45
[178] De Sadeleer, (n49), 17
[179] Ibid, at 5, 17
[180] Ibid.
[181] Beate Sjåfjell, 'The legal significance of Article 11TFEU for EU Institutions and Member States' in Sjåfjell B., Wiesbrock A., (eds) *The Greening of European Business under EU Law: Taking Article 11 TFEU Seriously* (Routledge, 2015), 51

‘Environmental protection requirements must be integrated into the definition and implementation of the Union’s policies and activities, in particular with a view to promoting sustainable development’.

Whilst te EIP is placed under Part I of TFEU in the category of principle of general application, the legal nature of sustainable development in EU law is indeterminate.[182] Sustainable development is encapsulated in a number of provisions in the EU Treaties without however being clearly defined.[183] Sustainable development is for example legally characterised as an overarching objective under Article 3(3) of the TEU and as a principle under the Charter of Fundamental Rights of the European Union.[184] From a non-binding declaration, the Charter of Fundamental Rights is now recognised as having the same legal status as Treaties by virtue of its incorporation in Article 6(1) TEU.[185] The formalisation of sustainable development at the Constitutional level as an objective of the European Union and as a principle complicates any attempts to determine its legal nature.

Consequently, the legal status of sustainable development is the subject of controversy. Sustainable development has been referred to as an EU objective of constitutional value by De Sadeleer.[186] According to Langlet, the fact that sustainable development is mentioned as a ‘principle’ in the ninth paragraph of the introduction to the TEU ‘reflects the Member States’ opinion that sustainable development has evolved into a legal principle’.[187] Sjåfjell also suggests that the codification of sustainable development in the environmental integration clause of Article 11 has strengthened its legal status as an

[182] De Sadeleer, (n177), 48
[183]Article 3(3) TEU, Article 3(5) and Article 21(2)(d) TEU, Article 11 TFEU
[184] Charter of Fundamental Rights of the European Union, Dec. 7, 2000 O.J C 364/1 (Charter of Fundamental Rights), Article 37
[185] Jan H. Jans, (n172), 1544
[186] De Sadeleer, (n177), 58
[187] Langlet and Mahmoudi, (n48), 43

EU law objective, a principle and rule at the same time.[188] It goes without saying that doctrinal controversies regarding the status of sustainable development raise the important question of hierarchy between Article 11 TFEU's requirement to integrate environmental protection requirements into non-environmental EU policies and actions, and Article 3(3) TEU which merely imposes a duty to balance competing environmental, social and economic interests. 'By definition, "principles" are endowed with a higher normative content than "objectives"'.[189] At first glance, this would appear to downgrade social and economic goals versus the environmental protection requirements of Article 11 TFEU.

Besides the question of the legal nature of sustainable development, an additional important legal issue arises: that of the legal substance of the environmental integration principle.[190] One may wonder what 'integration' means and whether environmental policy objectives should systematically be given priority in the process of integration?

A relevant interpretation of sustainable development and environmental integration has been given by AG Léger in *First Corporate Shipping*,[191] a case concerning the interpretation of Article 2 (3) of the Habitats Directive. Article 2(3) provides that economic, social and cultural requirements and regional and local characteristics must be taken into account in measures taken pursuant to the Directive. According to AG Léger, sustainable development 'does not mean that the interest of the environment must necessarily and systematically prevail over the interests defended in the context of other policies [...]. On the contrary, [sustainable development] emphasises the necessary

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[188] Sjåfjell, (n181), at 53

[189] Daniel Barstow D., Magraw and Lisa Hawke 'Sustainable Development' in Bodansky D., Brunnée J., Hey E. (eds.), *The Oxford Handbook of International Environmental Law* (Oxford Handbooks Online, 2008), 10

[190] Eloise Scotford, *Environmental Principles and the Evolution of Environmental Law* (1st ed., Hart Publishing 2017), 88

[191] Case C-371/98 *First Corporate Shipping* [2000] ECR I-09235

balance between various interests which sometimes clash but must be reconciled'.[192] This interpretation appears as 'a testament of the conciliatory nature' of sustainable development.[193] Notwithstanding AG Léger's position, the CJEU made no reference to sustainable development. The Court instead, held that ecological criteria are the only criteria to be taken into consideration when selecting N2000 sites.[194] Since its landmark decision in the *Leybucht Dykes* case,[195] the CJEU has systematically favoured the ecological objectives of the Habitats and Birds Directives in case of conflicts with the other objectives of the Treaty, in particular with economic and recreational considerations.[196]

In contrast to the conservative approach of the Court, Kingston *et al*., acknowledge that the '"constitutionalisation" of sustainable development in each of Article 3(3) TEU, Article 11 TFEU and Article 37 of the Charter of Fundamental Rights may reasonably demonstrate a belief, at the highest political level, that it is actually possible to achieve economic, social and environmental goals at the same time'.[197] Kingston further asserts that 'at the constitutional level, the EU not only acknowledges the important relationship between its economic and environmental policies, but proposes and indeed mandates [such] a balance'.[198] Since no hierarchy is expressly established between Article 3 (3) TEU and Article 11, there is a need to clarify what integration means and what constitute environmental protection requirements in the scope of the EIP. Particular attention must be paid to the important legal question of whether the EIP must

[192] *First Corporate Shipping*, Opinion of AG Léger, 7 March 2000, para. 54
[193] De Sadeleer, (n177), 50, 57
[194] *First Corporate Shipping*, paras. 24-25
[195] Case C-57/89 *Commission v Federal Republic of Germany (Leybucht Dykes)* [1991] ECR I-00883
[196] *Leybucht Dykes*, paras.21-22; Case C-355/90 *Commission v Spain* (conservation of wild birds) [1993] ECR I-4221, paras. 18-19
[197] Suzanne Kingston, Veerle Heyvaert, Aleksandra Čavoški, *European Environmental Law* (1st edn, Cambridge, Cambridge University Press, 2017), 15
[198] Ibid.

be interpreted in such a way that environmental protection requirements should systematically predominate in regulatory licensing for ORE projects.

5– Understanding the role of the Environmental Integration Principle in EU law

5.1 The multiple functions of the environmental integration principle

Pursuant to Article 6 of the Amsterdam version of the EC Treaty, Article 11 appears to mean that sustainable development would only be reached 'when environmental requirements are integrated into other policy' areas.[199] In analysing the nature of sustainable development in international law, Barral explains that:

> 'To equate sustainable development with the principle of integration would be unduly restrictive. Sustainable development is an objective that the International Community must strive to achieve, whereas the integration principle is the means by which sustainable development will be achieved. Hence, rather than *being* sustainable development, the principle of integration is the key technique for its realization'.[200]

A similar comment can be advanced with respect to EU law. The EIP is instrumental to sustainable development but does not intend to be synonymous with sustainable development. Interestingly, the term 'integrated' is not defined in the provisions of the Lisbon treaty, nor is 'environmental protection requirements'. 'Integration' finds its etymological origins in the Latin *integratio* meaning 'putting together parts or elements and combining them into a whole; becoming complete'.[201] Integration presupposes 'breaking down' the compartmentalisation of EU policies to promote a nexus approach

[199] Krämer, (n5), 87
[200] Barral, (n88), 381
[201] Voigt, (n7), 43

where governance acknowledges the interconnection between environmental policy and other policy domains.[202] Krämer argues that the EIP involves a 'continuous process' of 'bringing environmental requirements closer to EU policies and activities'.[203]

In the author's view, the EIP should be understood as a cross-cutting provision imposing a duty on EU Institutions to apply *mutatis mutandis* the objectives and principles of the environmental policy to all other policies and actions with a view to achieving sustainable development. In *Concordia Bus Finland,* the CJEU argued that environmental protection requirements extend beyond the confines of environmental policy and can be pursued in the context of public procurement.[204] According to the CJEU, the EIP 'emphasises the fundamental nature of the objective of a [high level of protection and improvement of the quality of the environment], and its extension across the range of policies and activities'.[205] The CJEU further held that any legal basis in the Treaties can be a legal basis for environmental protection.[206] The EIP has been instrumental in extending the limits of the Union's competencies, normally governed by the principle of conferral. McIntyre rightly notes in this respect that:

> 'In the light of the principle of environmental integration, the Union Institutions enjoy competence to take additional legal measures to ensure protection of the environment whenever they are acting in furtherance of a wide range of EU policies including agriculture, transport, energy and so forth'.[207]

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[202] Ingrid Boas, Frank Biermann, Norichika Kanie, 'Cross-sectoral strategies in global sustainability governance: towards a nexus approach' (2016) 16 (3) International Environmental Agreements: Politics, Law and Economics,449, 460
[203] Krämer, (n5), 84
[204] Case C-513/99 *Concordia Bus Finland Oy Ab v. Helsingin Kaupunki* [2002] ECR I-7213, paras.51, 57; Case C-428/07 *Horvath* v *Secretary of State for Environment, Food and Rural Affairs* [2009] ECR I-6355, para. 29
[205] Case C-176/03 *Commission v Council* [2005] ECR I-7879, paras.41-42; Case C-320/03 *Commission v Austria* [2005] ECR I-9871, para. 73
[206] Case C-440/05 *Commission v Council* [2007] ECR I-9097, para.60; Case C-300/89 *Commission v Council (Titanuim Dioxyde)* [1991] ECR I-2867, paras.22-25
[207] McIntyre, (n94), 112

As discussed in section 1 of this Chapter, the so-called ‘enabling function’ of the principle has been strikingly used by EU institutions to interfere with Member States’ sovereign rights to decide between different energy sources.[208] The EIP is not only relevant to extending the scope of Union’s competencies in the elaboration of EU legislation; it also helps in the interpretation of secondary law.[209] In particular, the EIP performs a so-called ‘guidance function’[210] whereby ‘European Union Law may – and indeed – must be interpreted in the light of the environmental requirements of Article 191 TFEU, even in areas outside the environmental field’.[211] Given the broad formulation of Article 191 TFEU, the substance of the integration principle encompasses ‘all conceivable environmental objectives, principles and criteria’ falling within the remit of the environmental policy.[212] In this respect, the notion of ‘environmental protection requirements’ has been broadly understood to include not only the aims of Article 191(1) TFEU, but also the environmental principles of Article 191(2) TFEU. The environmental principles listed under Article 191(2) include the precautionary principle, the principle of prevention, the polluter pays principle and the principle of rectification of environmental damage at source.[213] The EIP has played a pivotal role in justifying the application of the precautionary principle to aid in the interpretation of secondary EU legislations. This ‘guidance function’ was particularly relied up by the CJEU which continually gives an important doctrinal role to these environmental law principles to support a liberal approach to interpretation of EU directives both within and outside the ‘environmental sphere’[214] including public

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[208] Kim Talus, *EU Energy Law and Policy* (1st ed., Oxford University Press, 2013), 180
[209] Martin Wasmeier, ‘The integration of environmental protection as a general rule for interpreting community law’ (2001) 38 Community Market Law Review, 159
[210] McIntyre, (n94), 112
[211] Jans, (n172), 1541
[212] Gracia Marin Durán, Elisa Morgera, (ed.), *Environmental Integration in the EU’s External Relations: Beyond Multilateral Dimensions* (1st edn, Hart Publishing, 2012), 29
[213] TFEU, Art. 191(2), 2008 O.J. C 115, at 132
[214] Scotford, *Environmental Principles*, (n190), 149

health,[215] State aid,[216] movement of goods.[217] A clear cut example of how the doctrinal function has been used by the EU judiciary is given by the noteworthy *Waddenzee*[218] and *Sweetman*[219] cases, mentioned many times in this thesis.[220] In a similar approach, the meanings of 'waste'[221] and 'producer/holder of waste'[222] under the Waste Framework Directive (WFD)[223] were interpreted in a purposive and contextual manner in light of the polluter-pays principle, the preventive and the precautionary principle. In *Commune de Mesquer,*[224] the CJEU notably relied on an extensive interpretation of the polluter-pays principle to extend the notion of 'waste producer' and as such, the liability for bearing the cost of waste disposal, to the seller-charterer of hydrocarbons who 'has contributed' by its conduct to the risk of pollution.[225]

It is therefore within the context of the 'guidance function' of the EIP that the interpretive function of the precautionary principle has been elaborated by the EU judiciary to help in the interpretation of the Habitats Directive. From there, one may wonder whether the EIP of Article 11 TFEU necessarily calls for a strict formulation of the precautionary principle under the assessment requirements of Article 6(3) of the Habitats Directive.

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[215] Joined Cases T-74, 76, 83, 85, 132, 137, 141/00 *Artegodan GmbH v. Commission* [2002] ECR II-4945, para 183
[216] Case C-513/99 *Concordia Bus Finland* [2002] ECR I-7213, para.57
[217] Case C-379/98 *Preussen Elektra AG v. Schhleswag AG* [2001] ECR I-2099
[218] Case C-127/02 *Waddenzee* [2004] ECR I-07405
[219] Case C-258/11 *Sweetman and others v. An Bord Pleanála* [2013] ECLI:EU:C: 2013:220
[220] *Waddenzee*, para.58; *Sweetman*, paras.43, 48
[221] Case C-1/03 *Van De Walle v. Texaco Belgium SA* [2004] ECR I-7613, paras. 48-58; Case C-9/00 *Palin Granit* [2002] ECR I-03533, paras.23-24; Joined Cases C-419/97 and C-419/97 *ARCO Chemie Nederland Ltd* [2000] ECR I-4512, paras.39-40
[222] Case C-188/07 *Commune de Mesquer v. Total France SA and Total International Ltd* [2008] I-04501
[223] Directive 2008/98/EC of 19 November 2008 on waste and repealing certain Directives (Waste Framework Directive) [2008] O.J. L. 312/3
[224] *Commune de Mesquer*, (n222)
[225] Ibid, paras.82, 89

5.2. The environmental integration principle: systematic predominance of environmental objectives?

The incorporation of the terms ‘in particular with a view to promoting sustainable development’ by the Amsterdam Treaty certainly suggests that sustainable development is one of the objectives pursued by this provision. Legal commentators have stressed that the environmental focus of the EIP has been potentially ‘diluted’ by the introduction of ‘the qualifying objective to achieve sustainable development which allows economic and social consideration to be balanced against environmental requirements’.[226] This holds particularly true given the ‘proliferation of integration principles’ brought about by the Lisbon Treaty.[227] The obligation to integrate environmental protection requirements may no longer be regarded as an ‘exclusive priority’ in the post-Lisbon legislative era.[228] A number of cross-sectoral approaches are also binding under a number of additional integration clauses including inter alia in the areas of culture,[229] regional policy,[230] industry,[231] health,[232] internal market[233] and consumer protection.[234] Article 7 TFEU is probably the most significant cross-sectoral integration clause into the EU legal order. Article 7 TFEU provides that the ‘Union shall ensure consistency between its policies and activities, taking all of its objectives into account and in accordance with the principle of conferral of power’.[235] Its incorporation under Part I ‘Principles’ of the TFEU means that Article 7 lays down a general obligation applicable to all sectoral policy objectives covered by the Lisbon Treaty.[236] According to McIntyre,

[226] Scotford, (2017), (n190), 88
[227] Jans, (n172), 1545
[228] De Sadeleer, (2014), (n49), 22
[229] TFEU, Article 167(4)
[230] TFEU, Article 175
[231] TFEU, Article 173(3)
[232] TFEU, Article 168(1)
[233] TFEU, Article 114(3)
[234] TFEU, Article 12
[235] TFEU, Article 7
[236] De Sadeleer, (n49), 23

‘the principle of “consistency” amounts to a principle of “general” or “universal” integration of policy objectives bringing all policy requirements listed under the TFEU into play and requiring that each must be considered in the adoption of every measure to which it might be relevant’.[237] Therefore, two major integration clauses can be so far identified. First, the EIP, as codified under Article 11, which is specifically dedicated to ensuring that environmental protection requirements are given sufficient consideration in all Union policies and actions. Second, Article 7 TFEU also establishes a general obligation on EU institutions to take into account all EU policy objectives in the pursuance of EU policies. Legal scholars have developed different opinions regarding the legal interactions of Article 7 and Article 11. Krämer for example, explains that the principle of consistency under Article 7 should not be understood – ‘as meaning that the environmental objectives mentioned shall be considered as other, additional objectives of the transport, agricultural, fisheries policies and be treated as such’.[238] Krämer also argues that ‘there is a particular obligation for the EU institutions in the context of Article 7 TFEU to ensure that the different policies and activities work towards the objective of high level of protection and an improvement of the quality of the environment’.[239] Jans and Vedder defend an alternative interpretation. The existence of multiple integration clauses does not support the conclusion whereby environmental policy objectives have some measure of priority over other policy areas.[240] For Jans, ‘the integration principle is designed to ensure that protection of the environment is at least taken into consideration, even when commercial or other policy decisions are being made’.[241] ‘The manner in which potential and actual conflicts between protection of the environment and, for example, how the functioning of the internal market should

[237] McIntyre, (n94) 114
[238] Krämer, (n5), 91, 139
[239] Ibid.
[240] Jan H. Jans and Hans Vedder, *European Environmental Law After Lisbon* (4th edn, Europa Law Publishing, 2012), 23
[241] Jans, (n172), 1542-1543

be resolved cannot be inferred from the integration principle as such.'[242] Lee adopts a similar approach whereby 'the range of integration principles may have reduced the visibility and status of environmental integration'.[243] Environmental policy is no longer the only 'beneficiary of integration' and this, she argues, is more in line with the breadth of sustainable development: the proliferation of integration clauses 'puts paid to any lingering hope that environmental policy integration might be about the *prioritisation,* rather than the simple consideration of environmental values'.[244]

De Sadeleer developed a nuanced understanding of environmental integration by acknowledging that Article 11 'lays down a stronger commitment' than some of the other integration clauses.[245] De Sadeeler first acknowledges that there is no hierarchy established by the TFEU between the different EU policy objectives. 'Given that the EU institutions have important discretionary powers as to how they shape and prioritize their policies', De Sadeeler also considers that the 'environmental policy is not likely to have been accorded a particular priority over other policy areas'.[246] Nevertheless, the same author notes that unlike Article 7, the EIP 'poses a concrete obligation' to integrate and not merely to ensure 'consistency' with the environmental objectives and principles of Article 191(1), (2) of the TFEU.[247] If the environmental protection requirements of Article 11 may be given 'stronger weight', these shall remain consistent with the EU energy policy objectives for renewable energy. In this respect, De Sadeeler further points out that the obligation to ensure 'consistency' under Article 7 not only has a strong horizontal dimension but also a vertical one, which among other things, implies that the interpretation of secondary legislation must be consistent with EU policy

[242] Ibid.
[243] Lee, *EU Environmental Law, Governance and Decision-Making,* (n156), 69
[244] Ibid.
[245] De Sadeleer, (n49), 24
[246] Ibid.
[247] Ibid.

objectives, in particular that of combating climate change.[248] It is settled case law that EU institutions have 'to strike a balance between the relative importance of the environment objectives and other objectives as they proceed'.[249] The CJEU has held on numerous occasions that EU Institutions must endeavour to reconcile the various objectives laid down in the founding Treaties; a duty 'which does not allow one of these aims to be pursued in isolation [or] in such a way as to make the attainment of other aims impossible'.[250] Where it is possible to give some priority to environmental objectives,[251] priority should not 'close possibilities' to achieve the objectives pursued under other policies.[252] EU Treaties are forming a consistent legal system.[253] As such their 'provisions should be interpreted so as to help, and not hinder, the EU's other policy objectives'.[254] Likewise, EU institutions shall act within the limits of the power conferred on it in the Treaties and in conformity with the objectives set out in them.[255] In this vein, general objectives of EU law, and notably the objective of sustainable development, function as a framework for EU Institutions.[256] European Institutions, including the EU judicature must therefore ensure that the precautionary principle remains consistent with the achievement of renewable energy targets, initially adopted under the environmental policy. This dictum is also applicable to Member States and their national authorities responsible for implementing EU policy and law in light of the

[248] De Sadeleer, (n49), 23
[249] Case C-341/94 *Giani Bettati* [1996] ECR I-4355, para 35
[250] Joined Cases C-197/80, C-200/80, 243/80, 245/80 and 247/80 *Ludwigshafener Walzmühle Erling KG v. Council and Commission* [1981] ECR 3211, para.41; Case C-59/83 *Biovilac v. Commission* [1984] ECR I-4057, para.16
[251] Case C-280/93 *Germany v. Council* [1994] ECR I-4973, para. 47; Case C-122/94 *Commission v. Council* [1996] ECR I-881, para. 24
[252] Jans and Vedder, (n240), 23-24
[253] De Sadeleer, (n49), 25
[254] Suzanne Kingston, *Greening EU Competition Law and Policy* (Cambridge University Press, 2011), 97
[255] TEU, Article 13(2)
[256] Sjåfjell, (n181), 54.

principle of sincere cooperation,[257] imposing an obligation 'to refrain from actions which could jeopardise achievement of Union's objectives'.[258]

From there, the author supports the argument voiced by De Sadeleer. Article 11 certainly imposes 'a stronger commitment' on EU Institutions to take into account environmental objectives and principles of Article 191(1) and (2) TFEU when adopting and implementing policies and legal actions based thereon. However, 'environmental integration' does not mean that strict priority must be automatically given to ecological criteria when interpreting the provisions of the Habitats Directive. Article 11 TFEU would only formalise the 'ecological element' of sustainable development. This view also broadly corresponds to the position of Sjåfjel. Sjåfjel explains that Article 11 TFEU 'is a rule that refers to and strengthens sustainable development as an objective and which, at the same time, codifies the principle of sustainable development, particularly its operative environmental integration dimension'.[259] Sustainable development is a wider concept that goes beyond the imperative of environmental protection. Sustainable development as expressed by the CJEU in the *Laval*[260] and *Viking Lines*[261] judgements aims to integrate economic activities with the objectives of high level of employment and social protection.

Article 3(3) of the TEU seems to require a balancing exercise between various environmental, social and economic imperatives. However, simply restricting sustainable development to a mere balancing act between these competing imperatives would be a misconception. Voigt rightly outlines that, even though 'there is no doubt that balancing environmental, economic and a social factor is pivotal for sustainable

[257] Treaty of the European Union, Article 4(3), Article 282(1)
[258] TEU, Article 4(3)
[259] Sjåfjell, (n181), 53
[260] Case C-341/05 *Laval un Partneri Ltd v. Svenska Byggnadsarbetareförbundet* [2007] ECR I-11767, para.104
[261] Case C-438/05 *International Transport Workers' Federation and Finnish Seamen's Union v. Viking Lines ABP* [2007] ECR I-10779, para. 78

development, this does not necessarily mean that 'all three need to or even can be treated in the same manner or given the same weight'.[262] 'Integration' without a goal is devoid of sense.[263] In this vein, Voigt points out that 'integration' in the context to sustainable development must be subject to the ultimate goal of 'ecological integrity' or 'ecosystem integrity'.[264] This brings us back to the discourse on ecological sustainability, which as discussed in section 3.2, forms the 'ecological core' of sustainable development. 'Ecological sustainability cannot be achieved without climate mitigation actions. More now than ever, ecological sustainability requires the integration of the climate-energy objectives and biodiversity protection to halt degradation of biodiversity and ensure provision of ecosystem services to mankind (see section 3.2 above). If the declared aim of environmental integration is to achieve sustainable development, the principle should be instrumental to this goal. As a constituent principle of sustainable development, environmental integration cannot be interpreted as giving absolute priority to conservation goals. Instead, it should be operated to encourage more sophisticated trade-offs and equally maximise EU objectives for biodiversity conservation and renewable energy. Possible ways to achieve these trade-offs will be exposed in Chapter VI and VII.

262 Voigt, (n117), 150
263 Ibid.
264 Ibid, 147-148

6- Towards a new understanding of environmental integration in the field of renewable energy

6.1. The EIP and the promotion of renewable energy in CJEU's case law

Since its seminal decision in the so-called *Danish Bottles*[265] case, the CJEU has been described as a "constitutionalist actor" of substantive environmental integration in the EU's economic policy'.[266] The protection of the environment is one the Community's essential objectives which may justify restrictions to the free movement of goods. Interestingly, the Court has been particularly active in legitimising, on the grounds of the EIP, far-reaching restrictions to the free movement of goods in order to promote of use of renewable energy on the territory of Member States. In so doing, the Court added the promotion of renewable energy to the so-called *Cassis de Dijon*[267] list of imperative requirements justifying restrictions to the free movement of goods under Article 36 TFUE.

PreussenElektra[268] is certainly a landmark judgement in this respect. The CJEU, for the first time, explicitly relied upon the principle of environmental integration to justify derogation to Article 34 TFEU prohibiting quantitative restrictions to the free movement of goods to promote the use of domestically-produced renewable electricity.[269] At issue in *PreussenElektra* was the requirement that electricity retailers purchase a proportion of their electricity from locally generated wind energy. The CJEU had to decide whether German feed-in tariff imposing purchase obligations on electricity suppliers to favour domestic producers of green electricity were compatible with what is now Article 34

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[265] Case C- 302/86 *Commission v. Denmark (Danish Bottles)* [1988] ECLI: EU:C: 1988:421, para. 8
[266] Suzanne Kingston, 'The uneasy relationship between EU environmental and economic policies, and the role of the CJEU' in Sjåfjell B. and Wiesbrock A., (eds). *Sustainable Public Procurement: New Perspectives on the State as Stakeholder* (Cambridge University Press, 2015), 23, 48
[267] Case C-120/18 *Rewe-Zentral AG v. Bundermonopolverwaltung für Branntwein (Cassis de Dijon)* [1979] ECR 00649
[268] Case C-379/98 *PreussenElektra* [2001] ECR I-2099, paras. 68-81
[269] *PreussenElektra*, paras.74, 76 and 81

TFEU. The CJEU found that territorial restrictions aiming at promoting the use of renewable energy are ‘useful for the protection of the environment inasmuch as they contribute to the reduction of greenhouse gas emissions which are amongst the main cause of climate change that the EU and Member States have pledged to combat’.[270] At paragraph 76 of the judgement, the CJEU explicitly refers to the principle of environmental integration to conclude that the German support scheme was not incompatible with the fundamental rule of free movement of good in the single market.[271]

Five years after the Lisbon Treaty came into force, the CJEU in *Ålands Vindkraft AB,*[272] adopted a similar reasoning by analogy to *PreussenElektra*. By way of background, Sweden passed legislation restricting the benefit of green electricity certificates to renewable electricity installations located on the territory of Sweden. Ålands Vindkraft, a wind energy producer, sought approval from the Swedish Energy Authority for its wind farm located in Finland with a view to being awarded green electricity certificates. The application was refused on the ground that only green electricity installations located in Sweden can be approved for the award of green electricity certificates. An important question for preliminary ruling was referred to the CJEU to determine whether the Swedish legislation, restricting economic benefits attached to electricity certificates to producers established in Sweden, constituted a quantitative restriction on imports prohibited by Article 34 TFEU. If so, the CJEU had to decide whether these territorial restrictions could be justified in light of the objective of environmental protection. Unfortunately, the CJEU did not explicitly refer to Article 11 TFEU. Instead, the CJEU reiterated its statement in *Preussen Elektra* according to which the use of renewable energy is useful for the protection of the environment inasmuch as it

[270] Ibid, para.73
[271] Ibid, paras.76-81
[272] Case C-573/12 *Ålands Vindkraft v. Energimyndigheten* [2014] EU:C: 2014:2037

contributes to the reduction of greenhouse gas emissions which are amongst the main causes of climate change that the EU and its Member States have pledged to combat.[273] Recalling EU international commitments under the Kyoto Protocol, the CJEU confirmed its settled case law whereby national measures that are capable of hindering intra-Community trade may be justified by overriding requirements relating to protection of the environment.[274] From there, recognising that the Swedish legislation constituted a measure having equivalent effect to quantitative restrictions, the CJEU found that the objective of promoting the use of renewable energy was in principle capable of justifying restrictions to the free movement of goods.[275] Again, in *Essent Belgium*,[276] the Court reached the same conclusion: the objective of promoting the use of renewable energy, because of its contribution to the protection of the environment, is capable of justifying barriers to the free movement of goods.[277] In this case, the CJEU found compatible with Article 34 TFEU, a Flemish support scheme obliging national electricity suppliers to purchase green electricity certificates issued to producers of green electricity established in the Flemish region.

Furthermore, in *Ålands Vindkraft AB* and *Essent Belgium* cases, the CJEU had to consider whether the national support schemes and legislation met the requirements of the proportionality principle. In order to establish whether a restriction is proportionate, it must be shown that the contested legislation or measures 'do not exceed the limits of what is [both] appropriate and necessary to attain the legitimate objective pursued.[278]

[273] Ibid, para. 78
[274] Case C-320/03 *Commission v. Austria* [2005] ECR 1-9871, para.57
[275] *Ålands Vindkraft AB*, para.82
[276] Cases C-204/12 to C-208/12 *Essent Belgium NV v. Vlaamse Reguleringsinstantie voor de Elektriciteits* [2014] ECLI: EU:C: 2014:2192
[277] Ibid, paras. 90-95
[278] Ibid.

In *Ålands Vindkraft AB*, the CJEU found that the territorial limitation imposed on the issuance of green certificates was necessary to attain the legitimate objective of environmental protection pursued in the circumstances.[279] As a short comment on the proportionality test carried out by the CJEU, in *Ålands Vindkraft AB*, the Court considered that, once the green electricity has been allowed into the transmission or distribution system, it is difficult to determine its specific origin and, accordingly its systematic identification at the consumption stage as green electricity is difficult to put into practice'.[280] To justify the proportionality of the Swedish legislation as a whole, the CJEU relied on a number of arguments. In particular, the CJEU held that EU law has not harmonised the national support schemes[281] and assigned different mandatory national targets[282] taking into account differences in renewable energy potentials and energy mix of each Member States. In light of recital 25 of the REN Directive, the Court held that these differences justify that Member States are able to 'control the effect and costs of their national support schemes according to their different potentials' to ensure the proper functioning of national support schemes'.[283] While the necessity test appears to be satisfied, the restriction on importation of green electricity must also be appropriate to attain the legitimate objective pursued. In *Ålands Vindkraft AB*, the CJEU held that there was no doubt that the national support scheme was effective in creating incentives for electricity producers, suppliers or consumers to increase their production/use of green electricity. Consequently, it was not, according to the Court, possible to call into question the ability of the scheme to attain the legitimate objective of promoting the use of renewable electricity.[284] The CJEU had an additional refinement. The support scheme must be proven to function under effective and fair

[279] *Ålands Vindkraft AB*, (n272), para.118
[280] Ibid, paras.90, 96
[281] Ibid, para. 94
[282] Ibid, para. 97
[283] Ibid, para. 99
[284] Ibid, para. 112

conditions[285] 'to attain the legitimate goal pursued'[286] namely, the promotion of the use of renewable energy. The Court adopted a similar line of reasoning in *Essent Belgium*.[287]

A detailed analysis of the proportionality test applied by the CJEU in *Ålands Vindkraft* and *Essent Belgium* goes beyond the scope of this study. However, two related arguments can easily be put forward to 'rethink' the strict application of the precautionary principle when it comes to approving deployments of renewable energy technologies in the context of Article 6(3). What the author seeks to highlight here, is that in these two important decisions, the CJEU explicitly raised the objective of promoting renewable energy in the category of 'overriding requirements'[288] of environmental protection capable of justifying restrictions to one of the fundamental rules of the single market. What is more, the CJEU explicitly relies upon the EIP to justify this position. According to the Court, the promotion of renewable energy is 'useful for the protection of the environment' inasmuch as 'it contributes to reducing greenhouse gas emissions which are amongst the main causes of climate change that the EU and its Member States have pledged to combat'.[289] This is certainly a remarkable step towards acceptance by the Court that renewable energy is centrally important to achieve EU environmental policy objectives. In these cases, the EIP seems to extend the judicial principle of precedence to the promotion of renewable energy. The principle of precedence has been worked out by the CJEU in its case law on the precautionary principle to give 'precedence' to environmental and public health concerns over

[285] *Ålands Vindkraft AB*, paras.113-114
[286] Ibid, paras.113-114
[287] *Essent Belgium NV,* paras. 96-115
[288] *Ålands Vindkraft AB*, paras.77-82 ; *Essent Belgium NV*, paras. 90, 95
[289]*Ålands Vindkraft AB*, para. 78 ; *Essent Belgium NV*, para.91

economic interests (section 6.2.2 below).[290] Without going so far, one ought to argue that if the objective of promoting renewable energy is sufficiently important to restrict the functioning of the single market, it should, at least, be afforded the same weight as any other environmental goals within the scope of Article 11 TFEU. Stated differently, the guidance function of the EIP should foster a jurisprudential re-interpretation of the precautionary principle when examining applications for ORE development consents under the AA process of Article 6(3).

Less immediate but not less important, the Court does not exempt the EIP from the application of the principle of proportionality, which has been found, within the case law, to be a general principle of law.[291] Proportionality does not exclude an activity to be prohibited in the first place. However, 'when there is a choice between several appropriate measures, recourse must be had to the least onerous, and the disadvantages caused must not be disproportional to the aims pursued'.[292] It is frequently argued in the doctrine that the principle of proportionality entails a three-limb test: 1) the test of suitability/adequacy, 2) the necessity/less restrictive measures test and 3) the proportionality test *stricto sensu*.[293] It is under this later test that the genuine balancing exercise of the proportionality principle should in principle take place.[294] In the author's view, the two first limbs of the principle equate the 'effectiveness' requirement that Trouwborst summaries as follows: 'a measure is effective if it is likely to produce the

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[290] Case T-70/99 *Alpharma* [2002] ECR II-03495, para. 356; Case T-13/99 *Pfizer* [2002] ECR II-03305, para. 456

[291] Case C-331/88 *Fedesa and others* [1990] ECR I-4023, para.13; Case C-504/04 *Bad Doberan* [2006] ECR I-679 para.35

[292] *Fedesa and others*, para.13; Case C-157/96 *National Farmers' Union and others* [1998] ECR I-2211, para. 60; Case C-343/09 A*fton Chemical* [2010] ECR I-07027, para. 45

[293] Takis Tridimas, *The General Principles of EU Law* (2nd ed., Oxford University Press, 2006), 139; Tor-Inge Harbo, 'The function of the proportionality principle in EU law' (2010) 16 (2) European Law Journal, 158

[294] Jan H. Jans., 'Proportionality Revisited' (2000) 27 (3) Legal Issues of Economic Integration, 239, 248; Jans is caution not to explicitly include this third element of the proportionality test. He argues that even though the CJEU does not rule out a genuine balancing of interests in the context of a proportionality test stricto sensu, as a general rule the Court will not carry out such a test. Jans also notes that 'where a Member State has the power, apparently exclusive, to determine the level of protection a test of the proportionality *stricto sensu* is ruled out'.

outcome desired'.[295] The proportionality test *stricto sensu* in turns, requires that the level of protection afforded to one legitimate interest must be commensurate with the degree of disadvantage that this causes to other legitimate objectives.[296] Hence, the *stricto sensu* test operates as a 'counter-balance' to the effectiveness criterion: whilst 'effectiveness ensures that the outcome is served'; 'proportionality [stricto sensu] ensures that this is all that happens and no more than that, by adjusting the means to the objective'.[297] From there, even suitable and necessary measures can thus be found disproportionate if they impose an excessive burden on private interests, individuals or fundamental freedoms.[298] The three-limbs test has never been clearly endorsed by the CJEU. This complicates any attempt to determine the substance of the third *stricto sensu* component of test.[299] The *stricto sensu* test has sometimes been considered as part of the necessity test when identifying less restrictive alternatives.[300] Some authors also assert that the approach of the CJUE has varied slightly from a two-limb test to a three-limb evaluation of proportionality depending on whether the contested legislation or measure was enacted by Member States or EU Institutions.[301] Despite discrepancies in the application of the principle, the author will consider the proportionality principle in its tripartite dimension to challenge the particular interpretation of the precautionary principle, as crystallised by the CJEU in its interpretation of the assessment requirements of Articles 6(3) and (4) of the Habitats Directive.

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[295] Arie Trouwborst, '*Precautionary Rights and Duties of States* (Martinus Nijhoff Publishers, 2006), 148
[296] Case C-434/04 *Criminal Proceedings against Jan-Erik Anders Ahokainen and Mati Leppik* [2006] ECR I-9171, para. 26
[297] Ibid, p.149
[298] Tor-Inge Harbo, (n293), 165
[299] Ibid, 165
[300] Jans, (n294), 239
[301] Elizabeth Fisher, Bettina Lange, Eloise Scotford, (eds.). *Environmental Law: Test, Cases, and Materials* (Oxford University Press, 2013), 424

6.2. Rethinking the linkage between Articles 6(3) and 6(4) in light of the proportionality principle

The achievement of sustainable development demands a concerted effort to equally maximise the respective policy objectives for renewable energy and biodiversity conservation. 'Concerted effort' suggests that the interests of conservation and renewable energy should be proportionally balanced in decision-making. The EC Communication on the precautionary principle follows along the same line when it states that 'reliance on the precautionary principle is no excuse for derogating from the general principle of proportionality'.[302] Unlike *Ålands Vindkraft* and *Essent Belgium,* the CJEU does not explicitly refer to the proportionality principle in its seminal case law on the interpretation of Article 6(3) of the Habitats Directive. Rather, the CJEU performs a very light proportionality test when holding that the authorisation criteria under Article 6(3) 'integrate the precautionary principle and make it possible to effectively prevent adverse effects to the integrity of protected sites'.[303] 'A less stringent approach to authorisation under Article 6(3) could not ensure as effectively the fulfilment of the objective of site protection intended under that provision'.[304] In light of the 'three-limb' test described above, this ruling hardly satisfies the inherent requirements of the proportionality principle when applied to the particular context of offshore renewable energy.

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302 European Commission, 'Communication on the Precautionary Principle' (Communication) COM (2000) 0001 final, at 17

303 *Waddenzee*, (n218), para.58; Case C-258 *Sweetman*, (n219), para. 41; Case C-521/12 *TC Briels and Others* [2014] ECLI:EU:C: 2014:330, para.26; Case C-142/16 *Commission v. Germany (Moorburg)* [2017] ECLI:EU:C: 2017:301, para.40; Case C-323/17 *People Over Wind and Sweetman,* (n27), para. 30

304 Ibid.

6.2.1. Offshore renewable energy: an 'imperative' and 'overriding' public interest?

The Court's strict observance of the precautionary principle has placed a significant emphasis on the linkage between Articles 6(3) and (4). If after an AA process, the competent authorities conclude that there are reasonable scientific doubts as to the absence of potential impacts on a N2000 site, ORE projects can still be permitted under the derogation clause of Article 6(4) if competent authorities can prove that the project is necessary for imperative reasons of overriding public interest (IROPI).[305] As a matter of principle, AG Kokott has asserted that no failure to observe the principle of proportionality can be established in light of the derogating scheme of Article 6(4).[306] The Court has therefore assumed that Article 6(4) would be easy to employ in the event of a negative AA.

At first glance, the argument of AG Kokott appears sensible in light of the CJEU findings in *Schwarze Sulm River.*[307] Recognising the positive contribution of renewable energy to environmental protection and sustainable development, the Court has confirmed that the production of renewable energy from hydrokinetic sources can be considered as an overriding public interest justifying derogation under the WFD.[308] This decision may be seen as perfectly embedding 'a weighing to sustainable development'.[309] Although similar jurisprudence would surely be welcomed in the context of the Habitats Directive, *Schwarze Sulm River* does not stand as a general rule. In this particular case, the Court allowed the competent Austrian authority to authorise

[305] Case C-441/17 *European Commission v. Republic of Poland* [2018] ECLI:EU:C: 2018:255, para.190; Case C-164/17 *Grace and Sweetman*, (n26), paras. 52-54; *Waddenzee*, (n218), paras. 59-60; *Sweetman*, (n219), paras. 46-47

[306] Case C-127/02 *Waddenzee*, Opinion of Advocate General Kokott, 29 January 2004, para. 106

[307] Case C-346/14 *European Commission v. Republic of Austria* (*Schwarze Sulm River)* [2016] ECLI:EU:C: 2016:322

[308] Ibid, paras.69-71

[309] Frederik Kistenkas and Irene M. Bouwma, 'Barriers for the ecosystem services concept in European water and nature conservation law' (2018) 29 Ecosystems Services, 223, 225

the construction of a hydro-electric project on the basis of the derogation scheme of the WFD because the competent authority could justify that all the derogation conditions set out under that Directive were fulfilled.[310]

In the context of the Habitats Directive, many scholars have rightly stressed that Article 6(4) hardly provides a 'workable option' for many private-led ORE projects.[311] As an exception, the derogation of Article 6(4) must be interpreted restrictively and applies only after the conditions of Article 6(3) are satisfied.[312] Before they can qualify as part of the weighing process of Article 6(4), ORE technologies and their ecological footprints would still need to be precisely understood and weighted against the feature that may be damaged.[313] Likewise, the conditions of 'no alternative' solutions and of 'imperative', and 'overriding' public interest must still be cumulatively satisfied.[314]

Kokott notes that the concept of 'imperative' and 'overriding' have their equivalence in the test of proportionality in that the necessity of striking a balance results from these two concepts.[315] Article 6(4) defines the 'imperative' character of an interest by reason of its nature. Among other things, reasons of social and economic nature and, in the case of priority qualifying features, public health, public safety and consideration of 'primary' importance for the environment can be 'imperative'. In the Oxford Dictionary, 'imperative' refers to an 'authoritative command' to safeguard or achieve an interest 'of

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[310] Ibid, paras.77, 81; See further: Van Hees, 'Large-scale Water-related Innovative Renewable Energy Projects and the Water Framework Directive: Legal Issues and Solutions' (2017) 14 Journal for European Environmental and Planning Law, 315

[311] Schoukens and Cliquet point out that the derogation clause of Article 6(4) is not a 'workable option' for many private-based developments due to the restrictive conditions of IROPI and the additional costs and delays associated with this procedure. Henrik Schoukens, An Cliquet A, 'Biodiversity Offsetting and restoration under the European Union Habitats Directive: balancing between no net loss and deathbed conservation' (2016) 21(4) Ecology and Society, 572, 574

[312] *Briels and Others*, (n303), para.35; *Commission v. Republic of Poland*, (n305), para.189

[313] *Briels and Others*, para. 36*; Commission v. Republic of Poland*, (n305), para.188

[314] European Commission, 'Guidance Document on Article 6(4) of the Habitats Directive 92/43/EEC'. (2007/2012). Available at <http://ec.europa.eu/environment/nature/natura2000/management/guidance_en.htm>, (18 April 2017), at 10

[315] Case C-239/04 *Commission v. Portugal* [2006] ECR I-10183, Opinion AG Kokott, para. 45

vital importance'.[316] For example, in the EC guidance on Article 6(4), 'imperative' may refer to 'situations where a plan or project proved to be indispensable within the framework of action or policies aiming to protect fundamental values' including health, safety and environment'.[317] The 'public' and 'imperative' nature of combating climate change is now firmly embedded, within demanding and mandatory climate-energy targets, in public international law under the Kyoto Protocol and the Paris Agreement[318] of the UNFCC, and in EU law under the Renewable Energy Directive. The CJEU has also recognised the promotion of renewable energy as a mandatory requirement relating to the protection of the environment.[319] The Court further points out that 'an increase in the use of renewable energy is also designed to protect the health and life of humans, animals and plants, which are among the public interest grounds listed in Article 36 TFEU'.[320]

If an 'imperative' character could therefore easily apply to the ORE sector, the EC has reasoned in its written evidence on the Severn Tidal Energy Barrage, this does not necessarily mean that each individual project 'would automatically be of a sufficiently overriding character'.[321] The public interest must also be 'overriding': this means that a proposed development must be of such importance that it can be weighted up against the Habitats Directive's objectives of conservation.[322] Pursuant to the EC guidance on Article 6(4), the public interest is 'overriding' where, after a balancing exercise, national competent authorities have to make their approval subject to the condition that

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[316] The Oxford English Dictionary.
[317] European Commission, (n314), at 8
[318] Paris Agreement (adopted 12 December 2015, entered into force 4 November 2016) UNTS 54113
[319] Case C-379/98 *PreussenElektra*, (n268), paras.73-74
[320] *PreussenElektra*, (n268), para.75; *Ålands Vindkraft AB*, (n272), para.80
[321] Following a public inquiry on the proposal for the construction of the Severn Tidal Energy Barrage, the European Commission submitted a written evidence to the UK Parliament. Available at <https://publications.parliament.uk/pa/cm201314/cmselect/cmenergy/194/194we30.htm>; See further: Energy and Climate Change Committee, *A Severn Barrage ?* (HC 2013-14, 194-I), at 26-27
[322] Case C-182/10 *Marie Noël Solvay and others* [2012] ECLI:EU:C: 2012:82, para. 75; Case C-43/10 *Nomarchiaki Aftodioikisi Aitoloakarnanias and Others* [2012] ECLI:EU:C: 2012:560, para.121

the imperative reasons outweigh the conservation objectives of the affected site.[323] As discussed above, the notion of 'overriding' has been worked out by the CJEU to raise the objective of promoting renewable energy in the category of 'overriding requirements' of environmental protection capable of justifying restrictions to the operation of the single market.[324] In this respect, the Court has upheld national support schemes having equivalent effects to quantitative restrictions on import/export for the purpose of Article 34 TFEU.[325] If the objective of promoting renewable energy outweighs the economic freedoms of the Treaty, it is arguable that all individual ORE deployments will be recognised as truly 'overriding' in the context of the Habitats Directive. According to the Court, private developments only satisfied these conditions in exceptional circumstances: 'where a project, although of a private character, in fact by its very nature and by its economic and social context, presents an overriding pubic interest and it has been shown that there are no alternatives'.[326] Not every kind of public interest is sufficient to justify derogation. Only those of long-term benefit to the society are sufficient to outweigh the long-term conservation interests of the Directive.[327]

These conditions seem to be generally observed in national jurisdictions with some domestic courts having rejected recognition of an IROPI interest to small wind farm developments.[328] From there, one may reasonably assume that for the condition of 'overriding' interest to be satisfied, a proposed development will have to provide a meaningful contribution to the demand for electricity and CO_2 abatement. In the context of emerging technologies such as wave and tidal energy, it may be difficult for national

[323] European Commission, (2007/2012), (n314), at 8
[324] *Ålands Vindkraft AB*, (n272), paras.77, 82; *Essent Belgium NV*, (n276), paras.90-95
[325] Ibid.
[326] *Marie Noël Solvay and others*, (n322), para.77
[327] Ibid.
[328] Raad Van State, ECLI: NL: RVS: 2009:BH4011 (*Windturbines Emmapolder*). In this case, the competent Dutch authority failed to 'substantiate why more weight must be given to the installation of 17 wind turbines than to the conservation of the Natura 2000 site'. See further: Sander Van Hees, 'Large-scale Water-related Innovative Renewable Energy Projects and the Habitats and Birds Directives: Legal Issues and Solutions' (2018) European Energy and Environmental Law Review, 15

competent authorities to substantiate that a proposed development provides an overriding public interest. The rationale behind this is that these emerging technologies must first be tested and then deployed at necessary scales to meaningfully satisfy the demand for CO_2 abatement and renewable electricity. The importance of a project for CO_2 abatement and national renewable energy strategies must be sufficiently substantiated to justify an adverse impact on the integrity of the site via the derogation clause of Article 6(4). This has been confirmed, albeit h in the context of the Water Framework Directive, by the arguments of the European Commission (EC) in the *Schwarze Sulm* case. The EC questioned the 'overriding' character of the hydro-electric plant by arguing that 'hydroelectricity is only a source of renewable energy among others' and that 'the energy produced by the hydropower plant envisaged will only have a minor impact on the regional and national energy supply'.[329] The CJEU eventually dismissed the European Commission's action because the EC did not sufficiently substantiate its argumentation. Here again, competent national authorities enjoy a broad discretion to decide whether a specific project is of such 'overriding' importance in the context of Article 6(4).[330] For some authors, this may highlight a 'lack of integration'[331] between the derogation clause of Article 6(4) and the objectives of the REN Directive. Van Hees observes that the mere existence of Article 6(4) as a derogation does not in itself necessarily guarantee that the weighing exercise, which is mandated by sustainable development, will be carried out in practice to balance renewable energy production and biodiversity protection.[332] Instead, it seems to exacerbate the conflict between two sustainability-oriented objectives or 'green versus green dilemma'.[333] The derogation of Article 6(4), albeit described as a 'manifestation' of the proportionality

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[329] *Schwarze Sulm River*, (n307), para.82
[330] Ibid, para.70; Case C-239/04 *Commission v. Portugal* [2006] ECR I-10183, para.25
[331] Ibid.
[332] Van Hees, (n328), 28
[333] Lea Bulling and Johann Köppel, 'Exploring the trade-offs between wind energy and biodiversity conservation' in Geneletti D., (ed.), *Biodiversity and ecosystem services in impact assessment. Research Handbooks on Impact Assessment* (Edward Elgar, 2016), 299

principle and of the aim of sustainable development,[334] seems to provide a 'weighing of limited interest'[335] to the ORE sector.

Although the necessary balancing of the respective interests for ORE and biodiversity conservation may not be possible under Article 6(4) as it currently stands, a re-interpretation of the notion of 'overriding public interest' within the meaning of the Habitats Directive could facilitate greater integration between these imperatives. In a similar reasoning as *Schwarze Sulm River*, the 'high priority status' attached to the promotion of renewable energy[336] could also be recognised by the CJEU under the Habitats Directive and the 'overriding' and 'public interest' criteria of Article 6(4) re-interpreted on this basis to encompass all forms of ORE technologies. Although this re-interpretation will certainly encourage licensing authorities to give more importance to offshore renewables when applying the requirements of Article 6(4), the outcome of such a balancing act could still be debated. As noted above, competent authorities enjoy broad discretion to invoke the derogation clause and to decide upon whether more weight should be given to individual renewable energy projects. What is more, even if a general derogation rule for offshore renewables was enshrined under Article 6(4), permitting ORE projects to proceed under an IROPI condition would not necessarily lead to genuine sustainable outcomes guaranteeing adequate levels of protection to marine biodiversity. Worse still, it will be argued that facilitating the approval of ORE projects under Article 6(4) instead of Article 6(3) may not be compatible with the stated objectives of the Habitats Directive.

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[334] Stefan Möckel, 'The European Ecological Network "Natura 2000" and its derogation procedure to ensure compatibility with competing public interests' (2017) 23 Nature Conservation, 87, 91; Juan Palerm, 'The Habitats Directive as an Instrument to Achieve Sustainability? An Analysis Through the Case of the Rotterdam Mainport Development Project' (2006) 16 European Environment, 127

[335] Terms used by Kistenkas in: Fredrik Kistenkas, Irene M. Bouwma, (2018), Op. cit, (n309), p.224

[336] *Schwarze Sulm River*, (n307), para.73

6.2.2. The derogation clause of Article 6(4): a better safeguard of biodiversity conservation?

The core aim of the Directive consists in ensuring biodiversity through maintaining/restoring the conservation status of natural habitats type and species.[337] This entails, as the Court has already explained, 'the lasting preservation of the constitutive characteristics of the site'[338] that are necessary to optimise the site's contribution to the objective of favourable conservation status. ORE projects can only be considered under the scope of Article 6(4) if, despite the implementation of mitigation measures, the AA of Article 6(3) has found that prohibited adverse effects on the integrity of the site will occur or cannot be excluded beyond all reasonable doubt. In other words, the integrity of the site may still be adversely affected if proposed development is allowed to proceed for an imperative and overriding reason of public interest under Article 6(4). Unlike mitigation, the compensatory measures of Article 6(4) are not specifically directed at minimising or even cancelling the negative impacts on the integrity of the site and its qualifying features.[339] Rather, compensatory measures are independent of the project and tend to compensate after an adverse impact on the site's integrity has been done.[340] What is more, their aim is limited to the broad requirement of protecting the 'overall coherence' of N2000 network.[341] This presupposes that the network of N2000 sites was ecologically coherent in the first place and not only an 'ecological network on paper'.[342] Compensatory measures might consist

[337] Habitats Directive, Article 2 (1), (2)
[338] *Sweetman*, (n219), paras.37-39
[339] European Commission, (n314), at 10-13
[340] *Briels and Others*, (n303), para.31
[341] Habitats Directive, Article 6(4)
[342] Jonathan Verschuuren, 'Connectivity: is Natura 2000 only an ecological network on paper' in Born C.H. et al., (eds.), *The Habitats Directive in its Environmental Law Context: European Nature's Best Hope?* (Routledge Research in EU Law, 2015), 285

of 1) restoring or enhancing existing N2000 sites affected by the development, 2) recreating habitats on a new or enlarged site, or, 3) proposing a new N2000 site under the Birds and Habitats Directives.[343] In this respect, the EC guidance places a strong emphasis on the creation/restoration of biological values, natural habitats and functionality (functions and properties) comparable to those which had justified the selection of the site.[344] Here, the focus is on the need to provide 'comparable' functionality and not, as McGillivray observes, on the creation of 'an exact replication' of these functions.[345] The 'somewhat weak' success of compensatory measures in reinstating comparable ecological assets and functionality casts serious doubt on the suitability of the linkage between Articles 6(3) and (4) in achieving the objective of conservation pursued by the Habitats Directive.[346] The EC guidance recognises the 'intrinsic difficulties' of replacing ecological conditions.[347] It concedes that 'it is highly unlikely that ecological structures and functions as well as the related habitats and species populations can be reinstated up to the status they had before the damage by a plan or project'.[348] As the literature points out, the uniqueness and complexity of some ecosystems make the success of compensation measures even more uncertain[349] and subject to considerable time lags.[350] Approaches to marine habitat compensation exist in the marine environment.[351] However, poor knowledge of marine ecosystems, combined with the sparse and highly mobile nature of most marine fauna, makes the technical feasibility and prospect for success of marine biodiversity offsets expensive and

[343] *Briels and Others*, (n303), para.38; European Commission, (n314), 14
[344] European Commission, (n314), at 13-14
[345] Donald McGillivray, 'Compensatory measures under Article 6(4) of the Habitats Directive: No net low for Natura 2000?' in Born C.H. *et al*., (eds.), *The Habitats Directive in its Environmental Law Context: European Nature's Best Hope?* (Routledge Research in EU Law, 2015), 101, 104
[346] For a full discussion on the Commission's interpretation of the compensation obligation: McGillivray, (n345), 101
[347] European Commission, (n314), 17
[348] Ibid.
[349] David Moreno-Mateos and others, 'The true Loss Caused by Biodiversity Offset' (2015) 192 Biological Conservation, 552, 557
[350] Michael Curran, Stefanie Hellweg, Jan Beck, 'Is there any empirical support for biodiversity offset policy?' (2014) 24 (4) Ecological Applications, 617
[351] For an up-to-date review of marine biodiversity restoration/offsetting techniques: Céline Jacob and others, 'Marine ecosystem restoration and biodiversity offset' (2018) 120 Ecological Engineering, 585

inherently uncertain.[352] These have been raised as the main reasons why compensatory measures are rarely implemented in the context of European offshore wind farms.[353] A review of 55 offshore wind farm impact assessments reveals that only 7% of the compensatory measures envisaged by developers had the aim of offsetting the degradation of remarkable sites and none of these measures were properly designed.[354] Furthermore, compensatory measures may not lead to sustainable trade-offs in all circumstances.[355] Many times, the CJEU has stressed its 'suspicion' regarding the development of ecological equivalencies. The CJEU has repeatedly held that the putative positive effects of habitats restoration/compensatory measures - even when implemented prior to the commencement of construction works - are highly difficult to forecast with any degree certainty and therefore, these cannot be taken into account in the AA process of Article 6(3).[356] It is also worth noting that Article 6(4) does not require the same precautionary standard of Article 6(3) in relation to the effectiveness of compensatory measures.[357] A 'reasonable guarantee of success' based on the 'best scientific knowledge available', seems to be sufficient to approve a project under Article 6(4).[358] In this respect, Van Hoorick observes a '*contradictio in terminis'* in the ruling of the CJEU whereby Article 6(4), when interpreted in light of sustainable development, permits the conversion of a natural fluvial ecosystem into a man-made fluvial and lacustrine system.[359] According to Van Hoorick, this ruling would runs against the purpose of sustainable development. Indeed, it is arguable that by converting

[352] Adeline Bas and others, 'Improving marine biodiversity offsetting: A proposed methodology for better assessing losses and gains' (2016) 175 Journal of Environmental Management,.46
[353] Anne-Charlotte Vassière and others, 'Biodiversity offsets for offshore wind farm projects: The current situation in Europe' (2014) 48 Marine Policy, 172, 179
[354] Céline Jacob and others, 'The effectiveness of the mitigation hierarchy in environmental impact studies on marine ecosystems: A case study in France' (2016) 60 Environmental Impact Assessment Review, 83
[355] Roger Morris and others, 'The creation of compensatory habitat – can it secure sustainable development?' (2006) 14 (2) Nature Conservation, 106
[356] Ibid, para.32; Case C-164/17 *Grace and Sweetman v. An Bord Pleanála,* (n26), para.52; Joined Cases C-387/15 and 388/15 *Hilde Orleans and Others v. Vlaams Gewest* [2016] ECLI:EU:C: 2016:583, paras. 52 56
[357] McGillivray, (n345), 105
[358] European Commission, (n314), at 16-17
[359] *Nomarchiaki Aftodioikisi Aitoloakarnanias and Others*, (n322), paras.136-139

natural ecosystems into a man-made ecosystem, one can reasonably ensure the long-term coherence of N2000.[360] By contrast, he argues that avoiding and minimising encroachment in natural ecosystems certainly will.[361] As discussed above, the balancing of ORE interests and biodiversity conservation could possibly be contemplated through a re-interpretation of the normative term of 'overriding public interest'. The consideration of a development under the derogation scheme of Article 6(4) presupposes that, despite examination of mitigation measures aiming at avoiding or reducing negative impacts, the AA had failed to establish the absence of adverse impact on the integrity of the site. Given the weak prospect of success associated with marine biodiversity offsets, authorising smaller or medium-scale ORE projects with uncertain, yet lesser significant, and/or minor impacts, to proceed in tandem with appropriate mitigation measures under Article 6(3) certainly appears as a more sustainable approach than permitting larger-scale developments with established encroachments on N2000 sites' integrity to be deployed together with poorly effective compensatory outcomes.

The CJEU has made clear that derogation clauses cannot be 'contrary to both the spirit and purpose of the Habitats Directive'.[362] In practice however, there seems to be an apparent 'legal paradox'[363] between the cemented linkage of Articles 6(3) and (4) and the stated protection objectives of Article 2 of the Habitats Directive. The EC has consistently opted for a very permissive understanding of what reasons of public interest can be regarded as IROPI in the sense of Article 6(4). A number of large infrastructures including railway connections,[364] motorways,[365] airports[366] and port

[360] Van Hoorick, 'Compensatory Measures in European Nature Conservation Law' (2014) 10 (2) Utrecht Law Review, 161, 169
[361] Ibid.
[362] Case C-6/04 *Commission v. United Kingdom* [2005] ECR I-9056, para.113
[363] Tilak Ginige, and others, 'The Severn Tidal Energy Barrage project: a legal paradox' (2010) 21(2) Journal of Water Law, 66
[364] Commission Opinion, *Long distance and suburban railway connection from Bad Cannstatt to Stuttgart via the Rosenstein portal*, C (2018) 466 of 0 January 2018; Commission Opinion, *Botniabanen,*

extensions[367] with positive impacts for the economy and local unemployment[368] have received favourable opinions from the EC. Krämer contends that none of these opinions would successfully survive scrutiny by the CJEU.[369] Clutten and Tafur go so far as to state that the purpose of the Habitats Directive would be 'imperilled' by the flexible interpretation being accorded to IROPI.[370] Climate change considerations may rapidly be sufficient to outweigh the conservation objectives of the Habitats Directive if large-scale ORE deployments become an indispensable part of our electricity mix. Although at the time of writing, no large offshore wind farms have been approved pursuant to a positive opinion of the EC under Article 6(4),[371] this could rapidly become a workable option with respect to large offshore energy infrastructures falling in the category of 'project of common interest' under the TEN-E Regulation.[372] The TEN-E Regulation allows competent authorities to place more weight on the side of strategic energy infrastructures, including grid development works associated with large OWFs,[373] falling in the category of 'project of common interest'.[374] In many circumstances, the conditions of IROPI will thus be too high to be passed by smaller projects but

C (2003) 1309 of 24 April 2003; Commission Opinion, *TGV Est Development Plan*, C (2004) 3460, Opinion of 16 September 2004

365 Commission Opinion, *Widening of the B 173 between Lichtenfels and Kronach*, C (2015) 9085 of 18 December 2015

366 Commission Opinion, *Kalsruhe Baden-Baden Airport*, C (2005) 1641 of 6 June 2006

367 Commission Opinion, *Project Main Port Rotterdam*, C (2003) 1308 of 24 April 2003

368 Commission Opinion, *Prosper Haniel Colliery Development Plan*, C (2003)1304; Commission Opinion C (2010)3674 dated 11 June 2010

369 Ludwig Krämer, 'The European Commission's Opinions under article 6(4) of the Habitats Directive' (2009) 21 Journal of Environmental Law, 59,84

370 Rebecca Clutten, Isabella Tafur, 'Are Imperative Reasons Imperiling the Habitats Directive? An Assessment of Article 6(4) and the IROPI exception' in Jones G., (ed.) *The Habitats Directive: A Developer's Obstacle Course?* (Hart Publishing, 2012), 167, 182

371 See list of European Commission Opinions relevant to Article 6(4). Available at < http://ec.europa.eu/environment/nature/natura2000/management/opinion_en.htm>

372 Regulation (EU) No 347/2013 of 17 April 2013 on guidelines for trans-European energy infrastructure and repealing Decision No 1364/2006/EC and amending Regulations (EC) No 713/2009, (EC) No 714/2009 and (EC) No 715/2009 Text with EEA relevance [2013] (TEN-E Regulation) OJ L115.

373 Ibid, Annex I

374 Pursuant to Article 2(4) and Article 4, 'projects of common interest' are described as projects necessary to implement one of the energy infrastructure priority corridors and areas set out in Annex I. With regards to the environmental impacts addressed under Article (4), 'projects of common interest' shall considered as being of public interest from an energy policy perspective, and may be considered as 'overriding' provided that all conditions set out under Article 6(4) are fulfilled. See further: TEN-E Regulation, Articles 7(8)

ironically not demanding enough to prevent large-scale offshore developments from proceeding under derogation clause of Article 6(4). Stated differently, the strict linkage of Article 6(3) with Article 6(4) does not necessarily ensure acceptable levels of protection to marine habitats and species. It may instead prevent smaller projects with uncertain yet potentially less alarming impacts on N2000 sites from being authorised under the scope of Article 6(3) while permitting large-scale and truly harmful developments to proceed on the basis of Article 6(4) for imperative reasons of overriding public interest.

In conclusion, the dogmatic approach to conservation taken by the CJEU hardly seems to be compatible with the tenets of the 'necessity' and 'suitability test' underpinning the proportionality principle. As far as the violation of the proportionality test *stricto sensu* is concerned, this latter test should require weighing up the importance of the objective pursued with the interests that are threatened by that measure.[375] Weighing the respective importance of environmental protection, human health and economic considerations, the Court of Justice and the CFI have enshrined, on the basis of the precautionary principle, a general principle of precedence whereby the protection of human health, public safety and the environment must be given precedence over economic interests.[376] The Court went as far to state that the 'protection of public health must unquestionably take precedence over economic considerations'.[377] Imposing a precautionary withdrawal or ban on the use of additives in animal feed stuffs, antibiotics and pathogenic microorganisms in food waste, was thus not found disproportionate,

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[375] Nicolas De Sadeleer N., (ed.) *Implementing the Precautionary Principle: Approaches from the Nordic Countries, EU and USA* (London, Earthscan, 2007), p.38

[376] Joined Cases T-74/00, T-76/00, T-83/00, T-84/00, T-85/00, T-132/00, T-137/00, & T-141/00, *Artegodan GmbH v. Commission* [2002] ECR II-4945, paras.173, 184 ; Case T-392/02 *Solvay Pharmaceuticals BV* [2003] ECR II-4555, para.121 ; Case T-70/99 *Alpharma* [2002] ECR II-03495, para.356

[377] *Artegodan,* (n376), para. 173

even in the absence of evidence corroborating the reality of the risk.[378] AG Jacobs explains that 'if the set of environmental objectives involves a high level of protection, the restraint will inevitably be also higher'.[379] In this vein, Jacobs further argues that 'endorsing higher levels [of environmental protection] implies a readiness to accept more restrictive measures, as that is the very nature of proportionality'.[380] In light of the EC Communication on the precautionary principle, the proportionality of a measure must nonetheless be evaluated in light of 'the chosen level of protection'.[381] The final decision is therefore 'eminently political'[382] and seems to be guided, not by the scientific findings evaluating the risk, but by the constitutional objective to pursue a 'high level of [environmental] protection'.[383] A high level of environmental protection is entirely predicated on the pursuit of the newly incorporated objective of combating climate change. From there, the principle of precedence can hardly be invoked on the basis of precaution if it has for effect to complicate the achievement of climate-related objectives that are fully integrated into the environmental policy. 'By putting the brake on development unless Article 6(4) applies',[384] and as such, by placing so much importance on certainty in the context of Article 6(3), the jurisprudence of the CJEU disproportionally affects the ORE sector and obstructs innovation that is needed to tackle the impacts of climate change (Chapter IV, section 2.4). While some risk aversion is warranted in the presence of irreversibility, an overly high evidentiary burden under Article 6(3) may, on the other hand, encourage project developers and decision-makers to minimise the importance of uncertainty or 'to create certainty where it does not exist' with a view to reconciling the assessment with the interpretation of the

[378] Case C-97/83 *Melkunie* [1984] ECRI I-2367, paras.15, 17; Case T-392/02 *Solvay Pharmaceuticals,* Op. cit, para.150; CaseT-13/99 *Pfizer Animal Health SA* [2002] ECR II-03305, para.393
[379] Francis Jacobs, 'The Role of the European Court of Justice in the Protection of the Environment' (2006) 18(2) Journal of Environmental Law', 185, 195
[380] Ibid.
[381] European Commission, 'Communication on the Precautionary Principle', (n302), at 3
[382] Ibid, 3
[383] TFEU, Article 191(2)
[384] Emma Lees, 'Concretising the precautionary principle in habitats protection – Grüne Liga Sachsen v Freistaat Sachsen and Orleans v Vlaams Gewest' (2017) 19 (2) Environmental Law Review, 126, 131

Court. The fear of uncertainty may in turn prompt 'scientifically unsound' AA[385] thereby, reducing incentives to develop science-based strategies to reduce scientific uncertainty and improve future licensing decision-making for projects with obvious positive effects on climate change mitigation and biodiversity.

At first glance, an example of proportional examination may be illustrated by the decision of the UK Supreme Court in *Sustainable Shetland (Appellant) v The Scottish Ministers.*[386] The Supreme Court upheld a planning permission granted by the Scottish Ministers to an onshore wind farm. At issue was the failure of the Scottish Ministers to take proper account of their obligation under the Birds Directive with regard to the whimbrel population. The wind farm proposal was not located in the Feltar SPA but in the mainland area where the whimbrel population of the Shetlands was highly significant, representing 95% of the total UK population. The ornithological section of the Environmental Statement (ES) indicated that the population of whimbrel was poorly understood and, in the absence of previous wind farm developments, the likely impacts had been inferred from knowledge of other related bird species. The ES predicted that disturbance would result in the long-term displacement of 1.8 pairs which might be able to resettle elsewhere and a collision mortality rate of 3.7 birds per year. A Habitat Management Plan (HMP) was also designed by the developer which contained habitat management actions, restoration and control of predators to increase whimbrel breeding success. The Scottish Ministers were satisfied that the HMP would offer benefits to the conservation status of whimbrel and their habitats and considered that an estimate of 3.7 collision rate per year was very small when considered in the context of the 72-108 annual deaths from other causes. If, in spite of the implementation of the HMP, the negative impacts were to remain, these negative effects on conservation status of the

[385] Schoukens and Cliquet, (n311), 578
[386] *Sustainable Shetland v. The Scottish Ministers and another (Respondents)* [2015] UKSC 4

whimbrel population were outweighed by the benefits the project would bring in terms of substantial renewable energy generation and the support this offers to tackling climate change and meeting EU Climate Change Targets. The Supreme Court held that the Ministers were entitled to regard the limited anticipated impacts on whimbrels combined with the prospect of the HMP achieving positive improvements for the conservation status of the whimbrel population as a sufficient answer to the objections.[387] Unfortunately the Supreme Court missed the opportunity to address the question of whether the Ministers' reliance on balancing considerations (renewable energy and climate benefits) in the specific context of Article 2 of the Birds Directive was relevant in law.[388] The balancing factors in relation to the benefits of the project for climate change mitigation were, according to the Court, a 'fall-back position' which would only come into play if the Minister's primary reasoning was not accepted.[389] Therefore, the question of balancing renewable energy and protection of birds did not require determination by the Court. Nevertheless, the Supreme Court adds a compelling refinement when holding that 'as environmental benefits', these considerations must be distinguished from the more general 'economic benefits' referred to in Article 2 of the Birds Directive.[390]

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[387] Ibid, paras, 35-36

[388] Article 2 of the Birds Directive contains a general obligation to take measures to maintain the population of all bird species at a level which corresponds to ecological, scientific and cultural requirements, while taking account of economic and recreational requirements. The CJEU has consistently held that the economic and recreational requirements of Article 2 were not relevant when designating SPAs on the basis of the Birds Directive. The designation process can *solely* be based on environmental (ornithological) criteria (See: Case C-44/95 *Lappel Bank* [1996] ECR I-I-3805, paras. 24-26). Where no designation is involved, the CJEU nevertheless confirmed that the protection of birds guaranteed under Article 2 must be balanced against other requirements of economic or recreational nature (Case C- 247/85 *Commission v. Belgium* [1987] ECR I-3029, para.8). The exact weight to be given to these factors in the specific context of Article 2 is still debated.

[389] *Sustainable Shetland*, para. 37

[390] Ibid.

7- Conclusions: 'integration' but not predominance of environmental protection requirements over renewable energy objectives

The position of the EU judiciary under the regime of Article 6(3) of the Habitats Directive seems to embody 'silo thinking' - isolating the concept of biodiversity protection from the broadened challenge of climate change. In the particular context of renewable energy, the CJEU may have misunderstood the requirements arising from the environmental integration principle. As a constituent principle of sustainable development, the EIP does not infer 'prioritization' of biodiversity goals over climate-energy related objectives. Notwithstanding the existence of two distinct legal bases for renewable energy and environmental protection, the objective of sustainable development makes the integration of EU policy objectives for renewable energy and biodiversity even more explicit in the context of climate change. Since the entry into force of the Lisbon Treaty, climate change actions have to be taken under the scope of the environmental competence of the EU.[391] In this vein, the promotion of renewable energy has been found to be a significant driver of integration, sometimes blurring the separation between energy and environmental policies in the EU legal landscape. Some scholars begin to regard the promotion of renewable as a common objective of the environmental and energy policies.[392] This has been implicitly underpinned by the CJEU, including in the post-Lisbon era, in *Åsland Vindkraft*[393] and *Essent Belgium*.[394] The CJEU has recognised, on the grounds of the EIP, the objective of promoting renewable energy as an overriding requirement of environmental protection capable of justifying restrictions to the functioning on the single market. If the promotion of renewable energy is sufficiently important to restrict the operation of the single

[391] TFEU, Article 191(1), Article 192
[392] Sveen, 'The interaction between Article 192 and 194 TFEU', (n28), 182
[393] *Ålands Vindkraft AB,* (n272)
[394] *Essent Belgium NV,* (n276)

market,[395] a genuine balancing exercise reconciling the important objectives relating to renewable energy and biodiversity conservation should be envisaged earlier under the AA process of Article 6(3) and not only as a last resort within the derogation scheme of Article 6(4).

Despite long-standing controversies surrounding the legal nature of sustainable development, 'there is agreement that sustainable development in the hands of judges could operate as some sort of "intervening principle" mediating between potentially conflicting rules or principles'.[396] The overarching objective of sustainable development has already been used doctrinally by the CJEU to aid in the interpretation of the Habitats Directive. In *Nomarchiaki Aftodioikisi Aitoloakarnania,*[397] the Court took the view that the provisions of the Habitats Directive and more particularly Article 6(4), interpreted in the light of sustainable development, permits the conversion of a natural fluvial ecosystem into a man-made fluvial and lacustrine ecosystem.[398] As observed by Kistenkas, a balancing approach can therefore be achieved *infra legem* within the 'acquis communautaire' of the EU Treaties.[399] A contextual interpretation of Article 6(3) in light of the objective of sustainable development should pave the way towards a more flexible application of the precautionary principle in the particular context of renewable energy. That is, of course, easier to say than do. In *Rule of Law for the Nature,* Voigt notes that sustainable development, as a legal principle, has a role to play as a 'working tool for transforming and reforming the legal system'.[400] The same author however notes that sustainable development still 'awaits practitioners to shape it into a practical means of balancing conflicting interests [without] derogating from its

[395] *Ålands Vindkraft AB*, paras.90, 96
[396] Voigt, (n117), 155
[397] *Nomarchiaki Aftodioikisi Aitoloakarnanias and Others,* (n322)
[398] Ibid, paras.136-139
[399] Frederik Kistenkas, 'Rethinking European Nature Conservation Legislation: Towards Sustainable Development' (2013) 10 (1) Journal for European Environmental and Planning Law, 72, 79
[400] Voigt, (n117), 156

ecological core'.[401] Whilst the constitutional objective of sustainable development is certainly a powerful interpretative tool in the hand of the judiciary, the doctrinal function of sustainable development will not be of practical help for front-line decision-makers who are in charge of deciding upon development consents. A rigorous methodology embedding a science-based precautionary principle will certainly provide the operational framework that is currently missing to reconcile ORE developments and N2000 sites.

Fostering the integration of scientific knowledge into regulatory decision-making is a genuine condition of sustainable development.[402] 'Integration' in the context of sustainable development goes beyond the need to balance between ecological, social and economic competing imperatives. 'Integration', as Voigt rightly contends, demands that human activities and development occur within the ultimate limits or thresholds of ecosystem integrity.[403] 'These thresholds define the ecological constraints without which development cannot be sustainable'.[404] Ecological limits are poorly understood and this is precisely why science has a critical role to play to meaningfully inform regulatory decision-makers. In the next Chapter, the author demonstrates that the best way to maximise the use of scientific knowledge while assuring that ORE deployments do not unduly encroach on the integrity of N2000 sites is to promote and facilitate adaptive management.

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[401] Ibid.

[402] European Commission, 'The role of science, technology and innovation policies to foster the implementation of the Sustainable Development Goals' (2015). Available at <https://ec.europa.eu/programmes/horizon2020/en/news/role-science-technology-and-innovation-policies-foster-implementation-sustainable-development> (accessed 13 March 2017), at 80

[403] Voigt, (n117), 152

[404] Ibid, 153

CHAPTER VI

RECONCILING OFFSHORE RENEWABLES WITH NATURA 2000 SITES

AN INTERIM ADAPTIVE MANAGEMENT FRAMEWORK

1- Introduction

'*Resilience thinking provides inspiration for those who want to extend their thinking about sustainability, but it also challenges some ideas underpinning the impact assessment profession'*.[1] '*One important component of responsible and environmentally sustainable planning and operation of renewable energy sites is adaptive management'*.[2]

Forty years after Holling's seminal contribution in *Adaptive Environmental Management and Assessment*,[3] the importance of embracing the principles of resilience and adaptive management is still advocated, both in Europe and North America, as a better methodology to deal with scientific uncertainty in environmental assessments.[4] Drawing on the pioneering work of Holling *et al*., this Chapter investigates how

[1] Roel Slootweg and Mike Jones, 'Resilience thinking improves SEA: a discussion paper' (2011) 29(4) Impact Assessment and Project Appraisal, 263, 263

[2] Jones A., (2012). Best Management Practices for Siting, Developing, Operating and Monitoring renewable energy in the Intermountain West: A Conservationist's Guide. Report by Western Resource Advocates and Wild Utah Project. 95pp, at 76

[3] Holling C.S., and others, *Adaptive Environmental Assessment and Management* (London, Wiley, 1978)

[4] Aaron J. MacKinnon, Peter N. Duinker, Tony R. Walker, (eds.) *The Application of Science in Environmental Impact Assessment* (1st edn, Routledge, 2018); Alan J. Bond, and others, Managing uncertainty, ambiguity and ignorance in impact assessment by embedding evolutionary resilience, participatory modelling and adaptive management' (2015) Journal of Environmental Management, 97; Melissa H. Benson, Ahjond S. Garmestani, 'Embracing Panarchy, building resilience and integrating adaptive management through rebirth of the National Environmental Policy Act' (2011) 92 Journal of Environmental Management, 1420

adaptive management (AM) principles can be operated in the context of the appropriate assessment (AA) of the Habitats Directive to enhance decision-making in the face of knowledge gaps and uncertainty regarding the implications of ORE developments for Natura 2000 (N2000) sites.[5] More specifically, it suggests adopting a resilience perspective to inform the use of a threshold-based approach to AM to consent, deploy and operate ORE projects within the limits of the specified conservation objectives of N2000 sites.

As the ORE sector is rapidly growing, there is an urgent need to provide regulatory decision-makers with the best scientific knowledge concerning the real implications of ORE technologies for Natura 2000 sites. To do so, regulators and developers need the best management approach capable of delivering up-to date scientific data. Chapter IV has clearly emphasised that the overly strict precautionary principle prescribed by the CJEU under Article 6(3) is not suited to this need. Instead, it stands as a significant stumbling block to the approval of innovative ORE technologies thereby, slowing down the production of best scientific knowledge which is absolutely critical to support scientifically-informed regulatory licensing processes. In this particular context, 'learning while doing' is certainly the 'most appropriate type of caution'[6] where inaction would have the unacceptable effect of letting climate change proceed unmitigated.

Where uncertainty and data gaps are inevitable, AM may offer a better methodology to achieve the ecological outcomes of the Habitats Directive without unduly hampering the ORE sector. Whilst originally developed in the field of Canadian fisheries

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[5] Directive 92/43/ECC of the Council of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora [1992] OJ L 206/7

[6] Holy Doremus, 'Precaution, Science and Learning While Doing in Natural Resource Management' (2007) 82 Washington Law Review, 547, 555

management,[7] AM is now increasingly advocated as a more pragmatic approach to deal with scientific uncertainty in the field of biodiversity conservation.[8] AM is rooted in the theory of ecological resilience[9] and as such, it is increasingly recognised as central to deliver an ecosystem approach. In essence, AM is not a 'front-end' exercise but an iterative management process that accounts for inherent uncertainty in ecosystem dynamics and allows for that uncertainty to be reduced and for management to be improved over time as new information become available from monitoring.[10] Monitoring is designed to respond to specific scientific questions and hence contribute to the wider scientific knowledge base which can be used to amend decision in light of new information and refine policy and consenting processes. As such, AM may be regarded as a vehicle to incorporate the paradigms of 'post-normal science'[11] into environment assessments.[12] In the particular context of the Habitats Directive, an AM approach to appropriate assessment would typically accommodate scientific uncertainty, not by seeking to predict all possible impacts beyond a scientific doubt from a strict ex ante perspective, but by incorporating that uncertainty, encouraging learning through rigorously planned monitoring programmes, mitigation and adaptation in light of new science-based information.

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[7] Carl J. Walters, 'Is Adaptive Management helping to solve fisheries problems? (2007) 36 Ambio, 304; Carl J. Walters, Holling C.J., 'Large-Scale Management and Experiments and Learning by Doing' (1990) 71 (6) Ecology, 2060

[8] Rosie Cooney, 'A long and winding road? Precaution to practice in biodiversity conservation' in Fisher E., Jones J., Von Schomberg R., (eds.), *Implementing the Precautionary Principle: Perspectives and Prospects* (Edward Elgar, 2006), p.239; David A. Keith and others, 'Uncertainty and adaptive management for biodiversity conservation' (2011) 114 Biological Conservation, 1175

[9] Jim Berckley and Lance Gunderson, 'Practical Resilience: Building Networks of Adaptive Management' in Allen C.R., Garmestani A.S., (eds.), *Adaptive Management of Socio-Ecological System* (Dordrecht: Springer 2015), 201

[10] Ahjond S. Garmestani, and others, 'The Integration of social-ecological resilience and law' (2014) Nebraska Cooperative Fish & Wildlife Research Unit – Staff Publication 144, 365, 371

[11] Post-normal' science was developed by Funtowicz and Ravetz as a problem-solving strategy that better reflects the fact that science is never value-free or certain. In contrast to 'normal science', 'post-normal science is grounded in the assumption that scientific knowledge and understanding of natural systems is so incomplete that uncertainty, ambiguity and ignorance cannot be resolved without innovative or 'revolutionary science'. One of the central elements of 'post-normal' science is based on the management of uncertainty rather than on the banishment of scientific uncertainty. See further: Silvio O. Funtowicz, Jerome R. Ravetz, 'Science for the post-normal age' (1993) 25 (7) Futures, 739; Silvio O. Funtowicz, Jerome R. Ravetz, 'Uncertainty, complexity and post-normal science' (1994) 13 (12) Environmental Toxicology and Chemistry, 1881

[12] Bond and others, (2015), (n4), 99

AM is not new in the EU. The need for AM has been increasingly acknowledged in the guidance[13] of the European Commission (EC) to mitigate the effects of climate change on Natura 2000 sites.[14] Likewise, the approach has recently been implemented to minimise the risks posed by operating onshore wind farms on birds and bats.[15] AM has also been trialled to reduce scientific uncertainty associated with single tidal energy turbines or small arrays of turbines, including the SeaGen (Northern Ireland),[16] DeltaStream (Wales)[17] and Meygen (Scotland) projects.[18] Despite this, AM remains the exception rather than the standard and there is no clearly established legal basis for its implementation in EU law. As Ruhl rightly asserts, 'no other principle of natural resources management has so deeply permeated the practice on the basis of so little mention in the law'.[19] This observation equally applies to EU environmental law.[20] This

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[13] European Commission, 'Guidance on the implementation of the Birds and Habitats Directive in estuaries and coastal zones' (November 2011). <https://publications.europa.eu/en/publication-detail/-/publication/59287682-5723-464c-8e5c-b6f6fc263eaf/language-en> (accessed 20 August 2018)

[14] European Commission, 'Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment' (2013). <http://ec.europa.eu/environment/eia/pdf/EIA%20Guidance.pdf> (accessed 25 September, 2018); European Commission, 'Guidelines on Climate Change and Natura 2000' (Technical Report, 2013). <http://ec.europa.eu/environment/nature/climatechange/pdf/Guidance%20document.pdf> (accessed 2 June 2018)

[15] Luke Hanna and others, 'Assessing Environmental Effects (WREN): Adaptive Management White Paper'. Report by Berlin Institute of Technology, Bureau of Ocean Energy Management, Marine Scotland Science, Norwegian Institute for Nature Research, Pacific Northwest National Laboratory and US Department of Energy (DOE). 46pp. Available at <https://tethys.pnnl.gov/sites/default/files/publications/WREN-AM-White-Paper-2016.pdf> (accessed 15 February 2017)

[16] Graham Savidge and others, 'Strangford Lough and the SeaGen Tidal Turbine' in Mark A. Shields, Andrew I.L. Payne (eds.) *Marine Renewable Energy Technologies and Environmental Interactions* (Springer, 2014), 153

[17] Chloe E. Malinka and others, 'First in situ passive acoustic monitoring for marine mammals during operation of tidal turbine in Ramsay Sound, Wales' (2018) 590 Marine Ecology Progress Series, 247

[18] Jessica S. Jansujwicz and Teresa R. Johnson, 'Understanding and informing permitting decisions for tidal energy development using an adaptive management framework' (2015) 38(1) Estuaries and Coasts, 253

[19] Ruhl J.B., 'Adaptive Management for Natural Resources – Inevitable, Impossible or Both?' (2008) 54 (11) Proceedings of the Rocky Mountain Mineral Law, 3

[20] There is one reference to 'adaptive management' under the Marine Strategy Framework Directive (MSFD). The feedback loop of the AM process must be incorporated in marine strategies through a six years cycle of initial assessment (based on the determination of good environmental status, target setting, development of monitoring programmes and programme of measures), implementation and evaluation of marine strategies. See further: Directive 2008/56/EC of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive) [2008] OJ L.164/19, Articles 5 and 17

issue will be discussed in Chapter VII. This Chapter explores the question of whether and how AM could be taken further to enhance the management scientific uncertainty in the offshore wind energy sector and help scale up wave and tidal energy projects without adversely impacting upon marine Natura 2000 (N2000) sites.

Section 2 will first provide a brief primer on the notions of ecological resilience and Panarchy. Section 3 will make the case for a paradigm shift under the AA process of the Habitats Directive. Section 4 describes the concept and key elements of AM and provides examples of preliminary AM experiences in the ORE sector. Section 5 emphasises the role of AM in preserving ecosystems' resilience and thereby, in delivering an ecosystem approach. An 'interim' methodological framework to guide the use of AM strategies on a project-specific basis will be outlined in section 6. While the methodology presented below primarily focuses on marine species, the same approach could be applied to other receptors including marine habitats. As an interim solution however, the framework can be further enhanced and updated in tandem with improvements in the accuracy of scientific methods. The framework is also limited to the construction, operation and functioning of ORE projects and does not cover decommissioning or incidental activities such as ship-based maintenance operations.

2 - Resilience and Panarchy: some fundamental ecological notions

2.1. Resilience theory

Both the Convention on Biological Diversity[21] and the Millennium Ecosystem Assessment (MEA)[22] define 'ecosystems' as 'dynamic complex of plants, animals and communities and their non-living environment interacting as a functional unit'.[23] It is now widely understood in environmental sciences that ecosystems 'do not have single equilibria [but] multiple equilibria and destabilizing forces'.[24] Natural ecosystems 'are not static but in continual change'; change in numbers, change in equilibrium conditions and change in species composition.[25] In *Resilience and Stability of Ecological Systems,*[26] Holling firmly sets the fundamental premises of the resilience theory that he defines as the measure of the ability natural ecosystems to absorb incremental disturbances while maintaining the same relationships between populations or state variables.[27]. The rationales underlying this doctrine challenge what Holling refers to as the 'stability' paradigm or 'stable equilibrium',[28] whereby ecological systems are sufficiently stable to revert to their initial equilibrium state after temporary disturbances.[29] Holling points out that 'much of traditional ecological evaluation, policy design, and even ecological science itself presumes that once disturbance is removed, an ecosystem ultimately return its original condition'.[30] For Holling, such an 'equilibrium-centered' view is 'essentially static and provide little insight into the transient behaviour

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[21] Convention on Biological Diversity (adopted 5 May 1992, entered into force 29 December 1993) 1760 UNTS 79 (CDB)
[22] Millennium Ecosystem Assessment (2003), Ecosystem *and Human Well-Being*: *A Framework for Assessment* (Island Press, 2003)
[23] CDB, Article 2; Millennium Ecosystem Assessment (2003), p.51
[24] Holling C.S and Gary K. Meffe, 'Command and Control and the Pathology of Natural Resource Management' (1996) 10 Conservation Biology, 328, 332
[25] Ibid, p.333
[26] Holling C.S., 'Resilience and Stability of ecological systems' (1973) 4 Annual Review of Ecology and Systematics, 1
[27] Ibid, at 14, 17
[28] Holling and others, (1978), (n3), at 30
[29] Berckley and Gunderson, (2015), (n9), at 201
[30] Holling and others, (1978), (n3), 30

of systems that are not near the equilibrium'.[31] In essence, resilience contrasts with such deterministic perception of nature whereby ecosystems exist under one stable and controllable ecological regime. Instead, resilience acknowledges that ecosystems may exhibit abrupt, non-linear and unpredictable changes of ecological states.[32] It is based on the assumption that natural ecosystems 'can seem to be behaving according to one set of rules, until they suddenly flip into a radically different state' with alternative structures and functions.[33] In the face of incremental pressures, ecosystems reorganise, in a non-linear fashion, into a different ecological regime with a totally different mode of behaviour.[34] Commenting on Hollings' findings, Folke highlights that 'resilience is [therefore] about the opportunities that disturbance opens up in terms [...] of renewal of the system and emergence of new trajectories'.[35] In a similar vein, Garmestani and others emphasis that 'resilience' is about the capability of ecosystems to remain 'within a domain of attraction while exhibiting dynamic behavior'.[36] Each stability domain is characterised by an 'equilibrium' in terms of structure, function and biotic-abiotic interactions.[37] These sets of interactions are referred to by Holling and Meffe as 'stabilizing forces'.[38] Stabilizing forces operate as 'positive and negative feedbacks to maintain an ecosystem within an attraction domain and reduce the likelihood of regime shifts'.[39] If a breaking point is reached, ecosystems shift toward an alternative stability domain with different feedbacks, structure, functions and governing processes.[40]

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[31] Holling, (n26), 2
[32] Carl Folke and others 'Regime shifts, resilience, and biodiversity in ecosystem management' (2004) Annual Review of Ecology, Evolution and Systematics, 557, 574
[33] Holling and others, (n3), 33
[34] Holling, (n26), at 2, 3; Holling and others, (n3), 9
[35] Carl Folke, 'Resilience: The emergence of a socio-ecological systems analysis' (2006) 16 Global Environmental, 253, 259
[36] Ahjond J. Garmestani, Craig R. Allen, Heriberto Cabezas, 'Panarchy, Adaptive Management and Governance: Policy Options for Building Resilience' (2008) 87 Nebraska Law Review, 1036, 1038
[37] Holling, (1973), (n26), 4
[38] Holling and Meffe, (n24), 332
[39] Garmestani, Allen and Cabezas, (2008), (n36), 1038
[40] Holling, (n3), 33

In summary, while an 'attraction domain' determines the resilience capability of an ecosystem, resilience is the amount of shocks and disturbances that an ecosystem can withstand[41] without altering its stable ecological state. Resilience necessarily infers that ecosystems exhibit a certain degree of ecological integrity in order to be able to absorb and resist to incremental pressures.[42] Ecological integrity informs the degree to which 'complex adaptive systems are capable of self-organization and the degree to which these can increase the capacity for learning and adaptation'.[43] Natural ecosystems with 'greater integrity would be more resistant and resilient to the effects of changing patterns and types of disturbance'.[44]

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[41] Lance H. Gunderson and others, 'Resilience of Large-Scale Resource Systems', *in* Gunderson L.H., Lowell Pritchard, Jr. (eds.) *Resilience and the Behaviour of Large Scale Systems* (Island Press, 2002), quoted in: Mary J. Angelo, 'Stumbling Towards Success : A Story of Adaptive Law and Ecological Resilience' (2009) 87 Nebraska Law Review, 950

[42] Faber-Langendoen and others, (2012b) Assessment of wetland ecosystem condition across landscape regions: a multi-metric approach. Part B. Ecological integrity assessment protocols for rapid field methods (L2). U.S. Environmental Protection Agency report EPA/600/R-12/021b, Washington, DC – quoted in D. Brown E., William B.K., 'Ecological integrity assessment as a metric of biodiversity: are we measuring what we say we are? (2016) 25 Biodiversity Conservation, 1011

[43] Folke and others, (n32), 558

[44] Robert S. Unnasch and others, (2008) 'The Ecological Integrity Assessment framework: assessing the ecological integrity of biological and ecological resources of the national park system'. Report to the National Park Service, p.13; Jeffrey D, Parrish, David Braun Robert S. Unnasch, 'Are we conserving what we say we are?' (2003)53(9) BioScience, 851

2.2. The Panarchy cycle

The concept of resilience can be conceptually represented by the Panarchy framework (Figure 1). Panarchy, as Gunderson and Holling describe it, characterises the development process of ecological systems.[45] Panarchy suggests that all ecosystems evolve through a 'forward-loop' cycle of 1) growth (r), 2) stability or 'conservation' which is characterised by increased connectivity and rigidity of the resources within and across the ecosystem (k), 3) a back-loop phase of release or collapse (Ω) and 4) reorganisation (α).[46] The so-called 'reorganisation' or 'regime shift' is marked by rapid period of change where ecosystems move back, throughout the Panarchy cycle, towards a new stable ecological state of growth and conservation.[47] This transition from one stable conservation stage to a phase of collapse and reorganisation is also known as 'ecological thresholds'. Thresholds are defined as 'zones' of rapid and non-linear shift of ecological state (i.e. regime shift)[48] triggered by cumulative endogenous (from within ecosystems) or exogenous (eternal to the system) pressures.[49] A slight change in one anthropogenic or natural stressor may be sufficient to engender disproportionally large changes in ecosystems' states.[50]

[45] Lance Gunderson and Holling C.S. (eds.), *Panarchy: Understanding Transformations in Human and Natural Systems* (1st edn, Island Press, 2002), 33
[46] Ibid, at 47-49
[47] Bradley C. Karkkainen, 'Panarchy and Adaptive Change: Around the Loop and Back Again' (2005) 7 Minnesota Journal of Law, Science and Technology, 59, 62
[48] Kimberley A. Selkoe and others, 'Principles for managing marine ecosystems prone to tipping points' (2015) 1(5) Ecosystem Health and Sustainability,1, 3
[49] Melissa Foley and others, 'Using Ecological Thresholds to Inform Resource Management: Current Options and Future Possibilities' (2014) 2 (95) Frontiers in Marine Science, 1-12, 1
[50] Ryan P. Kelly, Ashley L. Erickson, Lindley A. Mease, 'How No to Fall Cliff, or, Using Tipping Points to Improve Environmental Management' (2015) 41 Ecology Law Quarterly, 843, 846

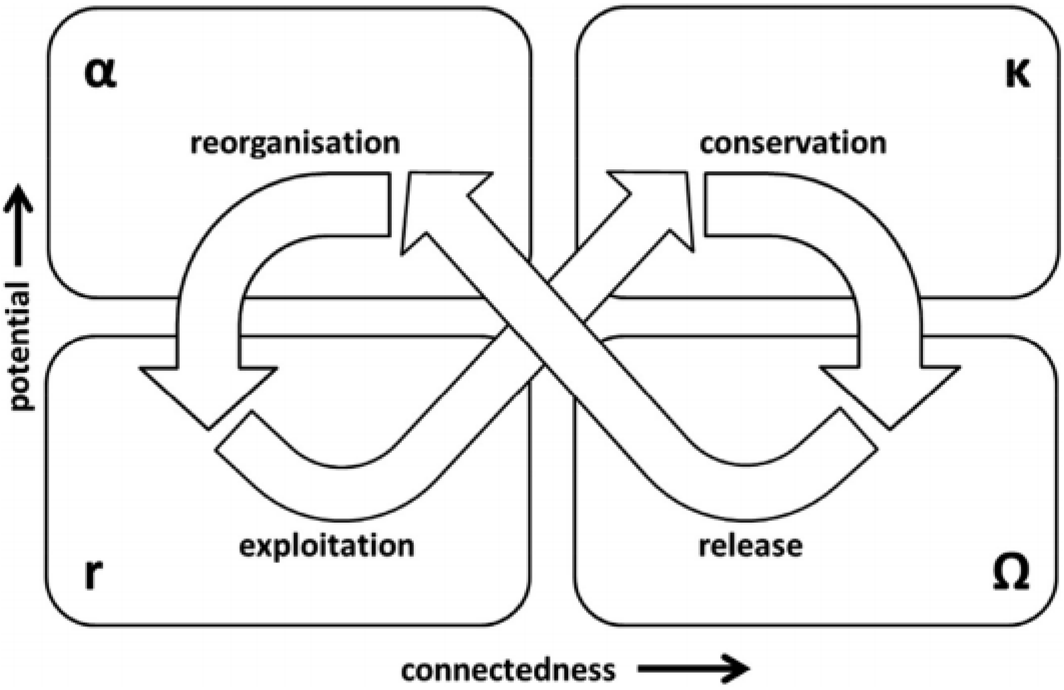

Figure 1 – The adaptive cycle of Panarchy (Gunderson L., Holling C.S., 2002)[51]

The cycle of Panarchy is the antithesis of hierarchy.[52] Whilst 'hierarchy implies top-down control of lower levels by higher levels, "Panarchy" implies that all 'levels or subsystems can influence one another'.[53] Unlike the 'top-down sequence of authoritative control' in hierarchy, the cycles of Panarchy are interdependent and operate in a feedback loop (Figure 1). 'The cycles of exploitation, conservation, release and reorganisation operate simultaneously and interact with other adjacent adaptive cycles at multiple temporal and spatial scales.[54] Connectivity enhances bottom-up exchanges and hence, facilitates the ripple-effect of local regime shifts.[55] When a phase

[51] Ibid, 34
[52] Gunderson and Holling, (n45), 21, 72
[53] MacKinnon, Duinker and Walker, (n4), 46
[54] Gunderson and Holling, (n45), 72
[55] Olivia O. Green and others, 'The Role of Bridging Organizations in Enhancing Ecosystem Services and Facilitating Adaptive Management of Socio-Ecological Systems' in Allen C.R, Garmestani A.S. eds., *Adaptive Management of Socio-Ecological System* (Dordrecht: Springer 2015), 107

of release and collapse occurs at small scale, it will diffuse across adjacent adaptive cycles to create ‘cascades of destabilization at larger scales’.[56]

The traits of resilience and Panarchy are exacerbated in marine ecosystems. ‘The marine environment is both an ecosystem and an ‘interlocking network of ecosystems’.[57] Unlike terrestrial ecosystems, marine ecosystems are ‘fluids in motion’[58] with three-dimensional physical environments (seafloor, water column and/or sea surface).[59] The three-dimensionality of the physical system means that the biome exhibits higher degrees of spatial complexity and biotic-abiotic interactions. The effect of convective hydrodynamic forces such as currents and tides play a critical role in the distribution of marine organisms.[60] Mechanisms of ocean connectivity contribute to enhancing cross-scale interactions between many processes and large-scale connectivity between species.[61] Selkoe and other explain in their writings that connectivity in the ocean facilitates the ‘ripple effect’ of localised regime shifts by linking distant communities.[62] Marine ecosystems are therefore particularly prone to nonlinear threshold responses.[63] A number of drivers such as increased nutrient input, sedimentation, invasive species, ocean acidification, global warming may prompt regime shifts in marine ecosystems.[64] Rocha and others have identified thirteen types of marine regime shifts.[65] The most illustrative examples of regime shifts caused by human induced pressures include

[56] Karkkainen, (n47), 63
[57] Statement on the Ecosystem Approach to the Management of Human Activities (First Joint Ministerial meeting of the Helsinki and OSPAR Commissions (JMM) Bremen, 25–26 June 2003), para. 3.
[58] Roger G. Sayre R.G and others, ‘A Three-dimensional Mapping of the Ocean Based on Environmental Data’ (2017) 30 (1) Oceanography, 91, 92
[59] Mark H. Carr and others, ‘Comparing Marine and Terrestrial Ecosystems: Implications for the Design of Coastal Marine Reserves’ (2003) 13(1) Ecological Applications, 90
[60] Ibid.
[61] Peter J.S Jones (ed.). *Governing Marine Protected Areas: Resilience Through Diversity* (1st edn, Routledge, 2014), 55
[62] Selkoe and others, (n48), 2, 4
[63] Juan Rocha and others, ‘Marine regime shifts: drivers and impacts on ecosystem services’ (2015) 370 Philosophical Transactions of the Royal Society B, 1
[64] Ibid, at 3-7
[65] Ibid.

marine eutrophication, coral transitions to macro-algae dominated systems, bivalve collapse, seagrass collapse and fisheries collapse.[66]

3 - The need for a paradigm shift under the 'appropriate assessment' of the Habitats Directive

'Now that [the scientific community] is experiencing a paradigm shift in its scientific understanding of nature, from static to fluid, [lawyers] will need to quickly follow that with similar paradigm shifts in their vision of nature in law'.[67] Forty years after Holling's fundamental contribution,[68] effective ecosystem-based management is still hampered by legal constraints associated with the so-called 'command and control'[69] pathology of environmental regulation. Generally speaking, 'command and control', also referred to in the EU context as 'direct regulation',[70] provides direct solutions to relatively 'well-bounded', clearly defined, predictable and linear societal problems. Its main feature involves solving problems either 'through control of the processes that lead to the problem [...] or through 'reactive' improvement of the problem after it occurs'.[71] Put simply, 'Command and control' pertains to the prescriptive nature of environmental regulations (the command), supported by a number of controls including licences, prohibitions and at the extreme end of the spectrum, sanctions (i.e. civil or criminal, revocation of licences).[72] Lee notes that examples of 'command and control'

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[66] Christian Mölmann and others, 'Marine regime shifts around the globe: theory, drivers and impacts' (2015) Philosophical Transactions of the Royal Society B, 1

[67] Kilyani Robbins, 'The Biodiversity Paradigm Shift: Adapting the Endangered Species Act to Climate Change' (2015) 27 (1) Fordham Environmental Law Review, 57, 80

[68] Holling, (n3)

[69] Holling and Meffe, 'Command and Control and the Pathology of Natural Resource Management', (n24), 328, 337

[70] Maria Lee, *EU Environmental Law, Governance and Decision-Making* (Modern studies in European law, Hart Publishing, 2nd ed., vol. 43, 2014), 82, 85; Suzanne Kingston, *Greening EU competition law and policy*. (Cambridge University Press, 2011), 43

[71] Ibid.

[72] Kingston, (70), 43

abound in EU environmental law.[73] Drawing on Abbot's work,[74] Lee observes that EU environmental law is deeply rooted in 'command and control' where fixed regulations (the command) together with the issuance of permits and authorisation (the control) are central to most environmental assessment procedures.[75] In the same line of thought, Schoukens stresses that the current interpretation of the Habitats Directive is deeply rooted in a 'command and control' approach whereby 'pursuant to a strict scrutiny, activities that might significantly impair protected habitats or species should be principally prohibited, unless they are covered by a specific derogation'.[76]

In this vein, it is worth noting that the purposive approach taken by the Court to interpret the normative notion of 'integrity of the site' fits well in the traditional 'command and control' approach. Similar to 'command and control', Chapter IV explained that reliance on the purposive method of legal interpretation has been primarily driven by the need to maintain the uniformity, consistency and predictability of EU law. In the particular context of the integrity test of Article 6(3), the purposive approach reinforces the 'control' aspect of command and control by imposing a very high precautionary scrutiny on new proposals in the vicinity of N2000 sites.

Legal certainty is also an important aspect of 'command and control'. Our legal systems are 'designed to provide social stability through reliance on precedent, prescriptive rules and adherence to procedure'.[77] As a result, law is more inclined to deal with fixed, linear and sectoral legal entities[78] and not with complex and unpredictable ecological entities. In EU law, legal certainty demands that 'rules [in particular those with negative

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[73] Lee, (n70), 82,85
[74] Carolyn Abbot, 'Environmental Command Regulation' in Richardson B., Wood S., (eds.), *Environmental Law for Sustainability* (1st edn, Oxford, Hart Publishing, 2006), 61
[75] Lee, (n70), 83
[76] Hendrik Schoukens, 'Reconciliation ecology in practice: Legal and policy considerations when implementing temporary nature on undeveloped lands in the European Union' (2017) 67 Land Use Policy, 178, 179
[77] Green and others, (n55), 333
[78] Mariachiara Tallacchini, 'A legal framework from ecology' (2000) 9 Biodiversity and Conservation, 1085

consequences for individuals] should be clear, precise and their application predictable for those subject to them'.[79] 'Individuals must be able to ascertain unequivocally what their rights and obligations are and take steps accordingly'.[80] Legal certainty is thus intrinsically linked to the principle of finality and predictability of legal decisions. Needless to say, the need for legal certainty does not sit easily with ecosystem realities characterised by non-linearity and unpredictable alternative regimes.[81]

The importance given to 'command and control' may have triggered what some scientists and environmental lawyers refer to as 'front-end'[82] approach to environmental assessment. This approach, which Noble also refers as 'blueprint approach',[83] assumes that accurate predictions of impact can be made from a strict *ex ante* perspective in the environmental assessment process: 'predictions of environmental risks influence the decision-making process and once a decision is made, the process is, for all intents and purposes, closed'.[84] As such, a static or 'front-end' approach to environmental assessment is typically characterised by 'one-time' predictions and a single model of mitigation measures.[85] This pathology also goes hand in hand with the predominantly practised 'baseline-led' model of impact assessment.[86] 'Baseline-led' takes existing baseline conditions as preferred equilibrium or 'benchmark' against which the potential

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[79] Case C- 209/96 *United Kingdom of Great Britain and Northern Ireland v. Commission of the European Communities* [1998] ECR I-05655, para. 35; Case C-226/08 *Stadt Papenburg v. Bundesrepublik Deutschland* [2010] ECR I-131, para.45
[80] Case C-158/06 *Stichting ROM-projecten v Staatssecretaris van Economische Zaken* [2007] ECR I-05103, para.25; Case C-248/04 *Koninklijke Coöperatie Cosun* [2006] ECR I-10211, para.79
[81] Garmestani, Allen and Cabezas, (n36), at 1042
[82] Ruhl J.B., 'Climate Change Adaptation and the Structural Transformation of Environmental Law' (2010) 40 Environmental Law, pp.363-431, 413; Robert L. Glicksman, Sidney A. Shapiro, 'Improving Regulation Through Incremental Adjustment' (2005) 52 University of Kansas Law Review, pp.1-70, 3
[83] Bram F. Noble, Strengthening EIA through adaptive management: a systems perspective' (2000) 20 Environmental Impact Assessment Review, 97
[84] Olivia O. Green and Ahjond Garmestani, 'Adaptive management to protect biodiversity: best available science and the Endangered Species Act' (2012) 4(2) U.S. Environmental Protection Agency Papers,199, 164, 170
[85] Ibid, 109
[86] Bond and others, *The Application of Science in Environmental Impact Assessment*, (n4), 100

ecological impacts of new developments are assessed and mitigated.[87] The interpretation of the Habitats Directive perfectly epitomises these core aspects of 'command and control'. In the context of the Habitats Directive, it is now settled case law that an AA is lawfully conducted if it identifies beforehand, and in the light of best scientific knowledge, the likely significant effects of a project on N2000 sites.[88] The CJEU has reinforced this dictum by holding that the legal test of 'no reasonable doubt' must be satisfied at the time of adoption of the decision authorising the implementation of the project.[89] The purpose of the AA is thus to prove, beyond a reasonable doubt and prior to the actual deployment of devices, that a proposed development will not adversely affect the integrity of a site, identified as a desirable baseline condition**.** Pre-consenting data are collected and used accordingly to derive one-time impacts predictions and design a single set of mitigation measures. There is no follow-up approach to environmental management. An AA is nothing more than a collation of historical data, the objective of which is to ensure, through a single-model of predictions and mitigation that ORE projects do not modify the integrity of N2000 sites envisaged as desirable 'baseline' equilibrium. Resilience is thus poorly acknowledged in the assessment procedure of the Habitats Directive. This thinking clearly embodies the equilibrium paradigm whereby ecosystems systematically return to a steady-state after disturbance.[90]

As far back as 1996, Holling and Meffe already cautioned against the pervasive effects of this pathology.[91] Without drawing a sharp distinction between marine and terrestrial ecosystems, they argued that 'command and control' does not provide a realistic

[87] Ibid; see further: Theophilus Hacking, Peter Guthrie, 'Sustainable development objectives in impact assessment: why are they needed and where do they come from?' (2006) 8(3) Journal of Environmental Assessment Policy and Management, 341
[88] Case C-127/02 *Waddenzee* [2004] ECR I-07405, paras.56- 59
[89] Case C-239/04 *Commission v Portugal* [2006] ECR I-10199, para.24
[90] Holling, 'Resilience and Stability of ecological systems', (n26), 2
[91] Holling and Meffe, (n24), 328

understanding of ecosystems' behaviours.[92] Holling and Meffe explain that ecosystems would become even less resilient when subject to 'command and control' management:[93]

> 'Policies and management that apply fixed rules for achieving constant yields [...] lead to systems that gradually lose resilience-systems that suddenly break down in the face of disturbances that previously could be absorbed'.[94]

Following on the same line, Raitanen stresses that 'a formalized legal process is important for enforceability but it also complicates the management of resilience, which is the prerequisite for the maintenance of biodiversity'.[95] When applied to complex natural resources problems, 'command and control' gives an illusion of control.[96] It seeks to eliminate or reduce in legal decision-making the range of natural variations inherent to all ecosystems in order to increase their predictability and make these systems more malleable and 'reliable' for human benefits.[97] Further, as discussed above, 'command and control' favours a 'front-end' model of decision-making which places too much confidence in the capacity of science to predict everything from a strict *ex ante* perspective. As complexity and uncertainty rises, 'confidence in the front-end decision-making method erodes'.[98] This approach is predicated on a 'static vision of nature' and as such, it lacks the necessary flexibility to tackle potential impacts that may materialise in systems characterised by non-linearity and unpredictability. Although 'command and control' may have been successful at dealing with 'point-source

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92 Ibid, 332
93 Ibid.
94 Ibid, 332
95 Elina Raitanen, 'Legal weaknesses and windows of opportunity in transnational biodiversity protection: as seen through the lens of an ecosystem approach-based paradigm' in Maljean-Dubois S., (ed.) *The Effectiveness of Environmental Law* (1st ed., Intersentia, 2018), 81, 94
96 Holling and Meffe, (n24), 328
97 Ibid, 329
98 Robin K. Craig and Ruhl J.B., 'Designing Administrative Law for Adaptive Management' (2014) 67910 Vanderbilt Law Review, 1, 19

pollution',[99] this approach is now perceived as 'continually outpaced, by more effective technologies, and by increasingly complex environmental problems'.[100] 'Tackling diffuse harms through direct regulation is more difficult'.[101] It is not surprising that, because of its 'polycentric, uncertain and dynamic nature', the governance of climate change is regarded as 'legally disruptive'.[102] Fisher *et al*. observe that:

> 'Polycentric means the relationship between cause and effect cannot always be linked in a linear way. Risk, uncertainty, and the delays in consequences in the changing climate, mean that assessment is heavily dependent on computational modelling. Scientific uncertainty is inherent in the process of modelling and, while models are developed as rigorous representations of reality, they are not "truth machine"'.[103]

Fisher argues elsewhere that the 'legally disruptive nature of climate change is also to do with the fact that mitigation strategies in response to climate change often require the creation of new infrastructures' in unstable physical environments.[104] The marine environment shares a number of the characteristics cited above and as such, marine ecosystems may also be thought of as equally disruptive from a legal point of view. Chapter III points out that marine ecosystems are subject to a wide range of natural variation and chaotic fluctuations that are not adequately modelled or understood by the scientific community. As rightly observed by Bond *et al*. changes of ecosystem's state

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[99] Ruhl J.B., 'Regulation by Adaptive Management: Is it possible?' (2005) 7 Minnesota Journal of Law, Science and Technology, 21, 22
[100] Lee, (n70), 84
[101] Ibid.
[102] Fisher Scotford and Barritt use the term 'legal disruption' to refer to the emerging legal challenges face by legal practitioners in climate change litigations. They argue that legal issues arising from the 'polycentric and uncertainty nature' of climate change impacts cannot be addressed through the conventional application of legal doctrine. See further: Fisher E., Scotford E., Barritt E., 'The Legally Disruptive Nature of Climate Change' (2017) 80 (2) The Modern Law Review,173, 177
[103] Ibid, 179
[104] Elizabeth Fisher, 'Law an d Energy Transitions: Wind Turbines and Planning Law in the UK' (2018) 38 (3) Oxford Journal of Legal Studies, 528, 531

subsequent to the implementation of a project 'are not necessarily something that can be avoided' insofar as these changes 'are in part determined by natural fluctuation in natural conditions".[105] As a result, no amount of observation prior to a device, or multiple devices, is actually deployed will reveal with absolute certainty the impacts those devices will eventually have on marine N2000 features. Holling also acknowledges that whilst some 'lessons can be learned from similar situations, and conclusions can be drawn from the general responses of disturbed ecological systems, post-project system is a new system, and its nature cannot be deduced simply by looking at the original one'.'[106]

These characteristics significantly hamper the capacity of science to make accurate predictions of impacts from a strict *ex-ante* perspective in the AA process. Empirical data on how marine animals and the physical environment interact with ORE devices is lacking. Existing data gaps coupled with the existence of natural variations and stochasticity mean that impact assessments heavily rely on simulation modelling.[107] Needless to say, model predictions rarely provide real representations of the properties and behaviours of marine ecosystems.[108] As a result, a number of potential positive or negative impact pathways may never be fully understood until devices are deployed and further empirical evidence is collected through monitoring at deployment sites.

In a nutshell, 'command and control' may have reached its limits in offshore areas. In dynamic marine environments characterised by stochasticity, one ought to acknowledge that even the highest *ex-ante* evidentiary standard of 'no reasonable scientific doubt' will never be an effective safeguard to prevent encroachments on the integrity of marine N2000 sites. In *Adaptive Environmental Management and Assessment*, Holling *et al*.,

[105] Bond and others, (n4), 100
[106] Holling and others, (n3), 133
[107] Helen Bailey and others, 'Assessing environmental impacts of offshore wind farms: lessons learned and recommendations for the future' (2014) 10(1) Aquatic Biosystems, 8
[108] Benjamin Planque, 'Projecting the future state of marine ecosystems, "la grande illusion"?' (2016) 73 (2) ICES Journal of Marine Science, 204

made a strong case for a 'back end'[109] approach to environment assessment that incorporates the basic properties of resilience and adaptive management. In order to live successfully with uncertainty, Holling argues that a 'major operational change is required to shift assessment from its traditional [front-loaded] role into meaningful environmental management'.[110] According to Holling, 'adaptive management is not really much more than common sense'.[111] An environmental assessment 'should be an ongoing investigation into, not a one-time prediction of, impacts'.[112] The best way to do so is to promote 'the continuation of assessment activities during and after the period of construction; such an extension of activity requires the addition of a monitoring capability'.[113] At the very least, Holling also asserts that 'monitoring provides an opportunity to attempt an invalidation of the analysis that has already been done. Prediction may not be possible but some post-diction is'.[114]

It is worth mentioning that the Habitats Directive was drafted at the beginning of the 1990's where the 'equilibrium centred view' of nature was predominating the scientific discourse. The Directive was adopted in 1992 and came into force in 1994 when the tenets of the ecosystem approach were also barely emerging in international environmental law (see section 5). The protection of the 'integrity of the site' is nonetheless very much contingent upon the implementation of an ecosystem approach, and this is generally considered to require adaptive management.[115] A change of

[109] The notion of 'back-end' approach has not been developed in Holling's doctrine. 'Back end' was first adopted by Professors Glicksman and Shapiro to describe decision-making processes that promote incremental adjustment of regulatory decisions to account for the actual impacts of regulations. These authors advocate a shift in focus from 'front end' to back end' regulatory decision-making: to prevent command and control from producing needlessly inefficient or undesirable environmental results. Back end adjustments provides 'a safety net' to protect against the risk of erroneous or incomplete decisions when agencies initially adopt regulations'. See further: Sidney Shapiro, Robert Glicksman, *Risk Regulation at Risk: Restoring a Pragmatic Approach* (1st edn, Stanford University Press, 2005), 164

[110] Holling and others, (n3), 135

[111] Ibid, 136

[112] Ibid, 133

[113] Ibid.

[114] Ibid.

[115] Arie Trouwborst, 'The Precautionary Principle and the Ecosystem Approach in International Law: Differences, Similarities and Linkages' (2009) 18 RECIEL, 26, 28

emphasis towards more adaptive AA processes is now necessary to account for paradigm shift: 'past ecosystems behaviour is no longer a useful indication of future system behaviour'.[116] While the element of 'command', characterised by a fixed requirement to carry out an AA, will remain a powerful tool to stave off biodiversity loss, the 'control' aspect of 'command and control' must incorporate some elements of flexibility and 'frequent recalibration' to reduce uncertainty and adapt in light of changing environmental conditions. Embracing the Panarchy cycle by introducing AM principles into the AA process should encourage a move away from the static 'predict-mitigate-implement' model of assessment towards more effective decision-making following the principles of 'predict-mitigate-implement-monitor-adapt'.[117]

[116] Bond and others, 'Managing uncertainty, ambiguity and ignorance in impact assessment', (n4), 100
[117] Angus Morrison-Saunders and Jos Art, (eds.) *Assessing Impacts: Handbook on EIA and a SEA follow-up* (Earthscan, 2012), 155, 171-175

4 – The theory of Adaptive Management

4.1. The procedural framework of adaptive management

Adaptive management, also referred to as a 'learning-by-doing' management process,[118] has been applied as a systematic approach for adapting and improving management by learning from previous management interventions. This approach acknowledges that scientific understanding of an ecosystem will always be incomplete and allows management actions to be re-adjusted over time to take into account new scientific data gained from ecosystem monitoring.[119] The onus is on the reduction of scientific uncertainty, which as discussed in Chapter III, may result from missing, incomplete or inadequate data (systemic uncertainty) or from the inherent complexity and variability of natural ecosystems (variability uncertainty). As stated above, AM is not a 'trial and error' approach,[120] but rather a process that promotes learning through careful management design, monitoring and periodic review of management actions in the light of new information.[121] To date, the most recognised definition of adaptive management is provided by the US Department of Interior (DOI) in their Technical Guide as: 'A flexible decision-making process that can be adjusted in the face of uncertainties as outcomes from management actions and other events become more understood. Careful monitoring of these outcomes both advances scientific understanding and helps adjust

[118] Byron K. Williams B.K., Robert C. Szaro, Carl D. Shapiro, 'Adaptive Management: The US Department of the Interior Technical Guide' (Adaptive Management Working Group, US Department of the Interior, Washington, DC 2009), at 7

[119] Glen Wright, Edward Willsteed, Anne-Marie O'Hagan, 'Ensuring the sustainable development of ocean energy technologies through environmental assessment laws and policies' in Wright G., Kerr S., Johnson K., (eds.) Ocean Energy: Governance Challenges for Wave and Tidal Stream Technologies (Routledge, 2018), 152

[120] 'Trial and error' commonly describes as an approach where policy or management actions 'try something, and if it does not work, try something else'. Byron K. Williams, 'Adaptive management and natural resources – framework and issues' (2011) 92 Journal of Environmental Management, 1346, 1347

[121] Rosie Cooney, Barney Dickson, (eds.), *Biodiversity ad the Precautionary Principle: Risk, Uncertainty and Practice in Conservation and Sustainable Use* (1st edn, Routledge, 2005), 304

policies or operations as part of an iterative learning process.[122] When applied to new ORE developments, this management approach allows decision-makers to accept certain levels of uncertainty regarding the putative impacts of a proposed development, whilst requiring data gaps and uncertainty to be reduced through continuous environmental monitoring and iterative revision of permitting conditions.

From a procedural perspective, AM involves a cyclical process of assessment, implementation, environmental monitoring, evaluation and adaptation of management decisions on the basis of data gained[123] (see figure 2). Simply monitoring and adapting management in light of up-dated information is not sufficient to do adaptive management. Under the DOI Technical Guide, AM entails exploring [beforehand] a series of management alternatives to meet [pre-agreed] management goals, 'predicting the outcomes of these alternatives based on the current state of knowledge, implementing one or more of these management alternatives, monitoring to learn about their impacts and then using the results to update knowledge and adjust management actions' on this basis.[124] AM is also described as a structured process of decision-making based on 1) a 'deliberative'/'set-up' phase and 2) an 'iterative phase'.[125]

The 'set-up' phase entails preparing an Environmental Management Plan (EMP) or Adaptive Management Plan (AMP) that frames the environmental problems in terms of uncertainty and data gaps to be addressed in the iterative phase.[126] This step of the procedure requires:

1) The identification of the potential impacts and uncertainty related to a plan/project;

[122] Williams, Szaro and Shapiro, (n118), 4
[123] Byron K. Williams and Eleanor Brown, 'Adaptive management: from more talk to real action' (2014) 53 Environmental Management, 465
[124] Williams, Szaro and Shapiro, (n118), 1
[125] Ibid, at 38; Williams and Brown, (n123), 467
[126] William and Brown, 'Technical challenges in the application of adaptive management' (2016) 195 Biological Conservation, 255, 257

2) The definition of measurable management objectives

3) The identification of a series of pre-defined management alternatives including mitigation and compensatory measures; and

4) The establishment of environmental monitoring programmes to assess the capacity of mitigation, compensatory measures to meet pre-defined management objectives.[127]

Objectives must be clear and measurable metrics against which the effectiveness of management actions can be evaluated through monitoring and improved accordingly.[128] If the objectives are not clear and measurable, then the AM framework is undermined.[129] It is during the iterative phase that management actions are implemented and evaluated against monitoring results. Mitigation/compensatory measures must be envisaged as a benchmark against which a monitoring programme is operated. Monitoring tracks system behaviour and in particular its response to management actions.[130] Monitoring serves the purpose of validating model predictions against empirical observation,[131] evaluating the success of management actions and prioritising management options in the next time period. Corrective management actions are warranted where knowledge gained from monitoring activities indicate that the effects of a particular management action deviate from the objectives agreed upon in the set-up phase. Follow-up monitoring is therefore a fundamental element to reduce uncertainty and optimise management outcomes as knowledge from the system accumulates.[132]

[127] Ibid.
[128] Williams, Szaro and Shapiro, (n118), 24
[129] Ibid, 11
[130] Ibid, 33
[131] Ibid, 31
[132] Ibid, 33

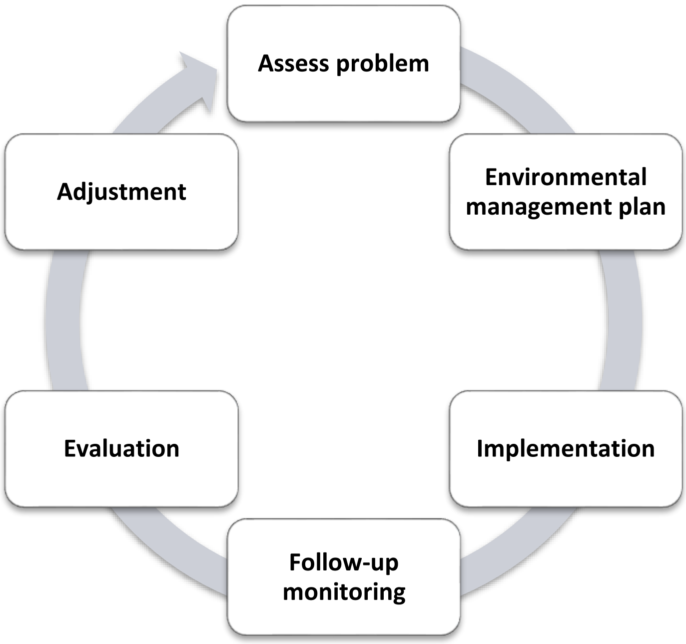

Figure 2 The cycle of adaptive management

(From: Williams B.K., Szaro C., and Shapiro C.D 2009)[133]

Stakeholder involvement is also a crucial element of adaptive decision-making. Participative decision-making generates learning outcomes that extend 'beyond the scope of science'.[134] Stakeholders should be involved early in the AM cycle, to help assess environmental problems, design management and monitoring activities and participate in the evaluation of monitoring results.[135] Collaborative or participatory AM processes also facilitate stakeholders' acceptance and produce robust knowledge on which to base management decisions.[136]

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133 Ibid, 5

134 Marie Fujitani and others, 'Participatory adaptive management leads to environmental learning outcomes extending beyond the sphere of science' (2017) 3 (6) Science Advances, 1, 1

135 Williams and Brown, (n123), 467

136 Fujitani and others, (n134), 1

4.2. Active adaptive management *versus* passive adaptive management

Adaptive management can be active or passive.[137] Even though the procedural process remains the same, active and passive adaptive management place different emphasis on 'learning' to guide the decision making process.[138] Active AM, which is also distilled down to '*learning by doing'*,[139] has 'learning' as a primary objective and treats each management action as 'deliberate probing for information'[140] in order to generate learning about the ecosystems being managed. In its active formulation, an AM approach designs and applies management actions as testable hypothesis.[141] In contrast, a passive approach to AM, or '*learning while doing*',[142] focuses on the effects of management decisions on natural resources without treating management actions as hypothesis-testing experimentations. Passive AM accounts for uncertainty but management decisions are not specifically designed as 'experimental probing' to generate information.

At first glance, active AM must be excluded from the scope of the Habitats Directive. In its active approach, AM implies that each ORE project would be regarded as an 'experiment' with licensing conditions (i.e. mitigation and choices in operating conditions) being designed to test and generate learning on the interactions of marine Natura 2000 species with devices. Here, a management action would be formulated as a hypothesis that is consciously 'put at risk' to generate knowledge. The Habitats Directive does not allow, for the purpose of learning, such experiments involving a deliberate risk of causing mortalities or physical disturbances to N2000 protected features. As discussed in Chapter IV, the Habitats Directive demands certainty that no

[137] Byron K. Williams, 'Passive and Active Management: Approaches and Examples' (2011) Journal of Environmental Management, 1371
[138] Ibid, 1372
[139] Carl J. Walters, C.S. Holling, 'Large-Scale Experiment and Learning By Doing' (1990) 71 Ecology, 2060
[140] Carl J. Walters, *Adaptive Management of Renewable Resources* (New York, 1985), 232
[141] Karkkainen, 'Panarchy and Adaptive Change', (n47), 70
[142] Doremus, 'Precaution, Science and Learning While Doing', (n6), 547

negative impacts will occur in the first place. A passive approach to AM may, by contrast, be particularly beneficial to reduce uncertainty regarding the interactions of protected species/habitats with ORE devices. Passive AM could be implemented more effectively, in compliance with the precautionary principle, to retire risks and inform the important question of whether monitoring methodologies and mitigation actions are effective in ensuring that the installation and operation of ORE projects satisfy the legal protection standard of the Habitats Directive. Whilst not conceiving management decisions as experimental, passive AM uses new science-based information collected through environmental monitoring as a means of checking the correctness of past model predictions[143] and ensuring that the implementation of consented developments does not compromise progress towards sites' conservation objectives (see below, section 6).

4.3. Preliminary experiences of adaptive management in the ORE sector

4.3.1 Wind energy sector

A recent review of AM practices in the wind energy industry reveals that despite the absence of formal regulations for AM, the use of the conceptual attributes of AM are progressively emerging to address onshore wind-wildlife interactions and, more specifically, impacts on bats and birds.[144] Post-consenting monitoring is commonly required in licence conditions but monitoring results are rarely used to improve the ongoing management of wind farm projects but rather inform future wind energy developments.[145] Frequently, data collection during the operational phase have served as

[143] James D. Nichols and others, 'On formally integrating science and policy: walking the walk' (2015) 52 Journal of Applied Ecology, 539
[144] Hanna and others, (n15), 20-26
[145] Lea Bulling and Johann Köppel, 'Exploring the trade-offs between wind energy and biodiversity conservation' in Geneletti D., (ed.), *Biodiversity and ecosystem services in impact assessment. Research Handbooks on Impact Assessment* (1st edn, Edward Elgar, 2016), 299–320

a means to adjust the specifics of monitoring programmes.[146] At best, monitoring outcomes have also informed adjustments of curtailment plans envisaged as mitigation measures to address collision risks of migrating birds and bats (see below).[147]

The most advanced examples of AM in the onshore wind energy sector can be found in Germany, the United Kingdom and in the United States.[148] In Germany, the Ellern wind farm park provides an example of management where specific requirements for monitoring (i.e. carcass survey and nacelle monitoring), together with pre-agreed thresholds of collision mortality for bats were linked to an adaptive curtailment plan.[149] After one year of operation, monitoring data were assessed and used to alter curtailment algorithms until mortality thresholds were no longer exceeded.[150] The same approach, based on specific species behaviour/events or mortality triggers, has been used in other European countries including Switzerland (Gries wind farm),[151] Spain and Portugal (Candeeiros wind farm)[152] and the United States (Alta East Wind Project).[153]

In the offshore wind energy sector, the application of AM is limited. Hanna and others point out that the United Kingdom provides the closest example to a true AM approach, as prescribed in the US. Department of the Interior Technical Guide (cited above).[154] Monitoring programmes are commonly informed by environmental assessments and then required under licence conditions. Monitoring is implemented throughout the life time of consented offshore wind farms (OWFs) to improve the state of scientific knowledge and facilitate the approval of future developments as part of a 'double

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[146] Helena Coelho, Silvia Mesquita and Miguel Mascarenhas, 'How to design an adaptive management approach' in Mascarenhas M., et al., (eds.) *Biodiversity and Wind Farms in Portugal*: *Current Knowledge and Insights for an Integrated Impact Assessment Process* (Springer, 2018), 205
[147] Hanna and others, (n15)
[148] Ibid, 21-25
[149] Johann Köppel and others, 'Cautious but Committed: Moving Towards Adaptive Planning and Operation Strategies for renewable energy's wildlife implications' (2014) 54 Environmental Management, 744, 750
[150] Ibid.
[151] Hanna and others, (n15), 23
[152] See further: Coelho, Mesquita and Mascarenhas, (n146), 216
[153] See further: Bulling and Köppel, (n145), 313
[154] Hanna and others, (n15), 29

feedback loop'.[155] The Survey-Deploy-Monitor (SDM) policy,[156] introduced by Marine Scotland, is regarded as an example of AM in the pre-consenting phase.[157] The SDM policy allows for pre-consenting monitoring requirements to be tailored to the risk-profile of ORE developments and adjusted over time on the basis of information gained.[158] The SDM has been applied to inform consenting requirements for the Hywind Floating Wind Demonstrator project.[159] Hywind was assessed as a medium-risk proposal requiring one year of site characterisation surveys with subsequent review at the end of that year to determine the need for further survey efforts. After one year of pre-consent survey, it was found that there was a spike in auk (*Alcidae*) numbers during the post-breeding season. Additional data collection during this period was agreed before proceeding to consenting. Development consent was granted in 2015.[160] Although the SDM policy may contribute to rationalising post-consent monitoring efforts for relevant sensitive receptors, it does not specify how new knowledge should be incorporated in the post-consent phase to inform ongoing project management.[161]

The Cape Wind project is the first proposed offshore wind farm in the United States that has been granted a commercial lease by the Bureau of Ocean Energy Management (BOEM). In the early stage of the consenting process, an Avian and Bat Monitoring

[155] Bald J., and others, Review of the state of the art and future direction of the Survey, Deploy and Monitor policy. Deliverable 3.1., RICORE Project. 29pp. Available at < http://ricore-project.eu/downloads/> (accessed 9 October 2018), at 28
[156] Marine Scotland, (2016) 'Survey, Deploy and Monitor Guidance'. <https://www.gov.scot/Topics/marine/Licensing/marine/Applications/SDM> (accessed 14 June 2018)
[157] Wright, Willsteed and O'Hagan, (n119), 153
[158] Under the SDM, two years of baseline data collection would be the minimum required to inform an AA process for high risk proposals. For medium risk proposals, the initial presumption would require two years of baseline data but flexibility is allowed to relax monitoring requirements on a case-by-case basis where environmental risks are less than anticipated or that the monitoring data gathered are sufficient to inform an AA process. At the lower end of the risk scale, proposals would need only one year of baseline monitoring. If survey data alters that further investigation is necessary, the SDM policy allows for the licence application to be processed in parallel with additional survey works. See further: Marine Scotland, (n156), at 1-4.
[159] Hywind has been installed by Statoil off the coasts of Peterhead in Scotland. The project consists in 5 floating offshore wind turbines generating a total capacity of 30MW.
[160]See further: Marine Scotland, Hywind Marine Licence (November 2015). <https://www.gov.scot/Topics/marine/Licensing/marine/scoping/Hywind/marine-licence> (accessed 22 August 2018)
[161] Cape Wind. (2014) Litigation history of Cape Wind. Available at <http://www.offshorewindhub.org/resource/1523> (accessed 1st March 2018)

Plan incorporating an adaptive approach to monitoring and mitigation was elaborated for bats and bird species protected under the Migratory Bird Treaty Act and Endangered Species Act.[162] The project was cancelled in 2017 due to many delays in the planning process and a series of lawsuits fuelled by public opposition.[163]

4.3.2 Tidal energy sector

The following case studies provide practical examples of how AM has been applied to various consented tidal energy projects to reduce uncertainties. While a staged approach to consenting has been favoured to authorise offshore tidal arrays under an AM scheme, an alternative approach also consists of using AM as part of conditional approvals for single devices. This is the approach that was applied at the Meygen project (Scotland), SeaGen Tidal Energy project, in Strangford Lough (Northern Ireland), the Cobscook Bay tidal energy pilot project (United States) and Delta Stream Tidal Energy project (Wales).

4.3.2.1 Meygen Tidal Energy Project, Pentland Firth, Scotland

The demonstration strategy approach at the Meygen Tidal Energy project in Pentland Firth (Scotland) is a model of commercial tidal development for which an adaptive approach has been applied through a staged consenting process. Development consent was granted by Marine Scotland, on behalf of the Scottish Ministers, for the

[162] ESS Group, (2012) Final Cape Wind Avian and Bat Monitoring Plan (ESS Project No. E159-504). <https://www.boem.gov/uploadedFiles/BOEM/Renewable_Energy_Program/Studies/Cape%20Wind%20ABMP.pdf> (accessed 10 August 2018)

[163] Brian Eckhouse, Joe Ryan, 'Climate Changed: What was once hailed as first US offshore wind farm is no more' *Bloomberg* (1st December 2017). <https://www.bloomberg.com/news/articles/2017-12-01/cape-wind-developer-terminates-project-opposed-by-kennedys-koch> (accessed 8 October 2018); See further: BOEM, Lease and Grant Information. < https://www.boem.gov/Lease-and-Grant-Information/> (8 October 2018)

construction and operation of sixty-one fully submerged turbines with a permitted capacity of 86MW.[164] The conclusions of the AA process found that significant adverse effects would occur as a result of predicted levels of collision with protected species including sea birds, grey seals, harbour seals, Atlantic salmon and sea lampreys. Other potential impacts were related to the loss of foraging habitats and displacement of seabirds due to the presence of the turbines as well as to the effects of acoustic noise and electro-magnetic fields on fish passage. To mitigate these risks, the AA indicated that 'an initial first phase deployment of six turbines is recommended with a comprehensive post-construction monitoring programme to inform future phases'.[165] Therefore, the approval was made conditional upon the company (Meygen Ltd) deploying the turbines in distinctive development phases. Meygen Ltd is also required to submit an application for approval to Marine Scotland before proceeding with each subsequent development phase. Further AA processes must be conducted by Marine Scotland prior to the authorisation of any subsequent phase in order to ensure that approval is given with full knowledge of the implications of the turbines for N2000 features.[166] Phase 1 was approved in September 2014 in tandem with the initiation of monitoring programme designed to measure the behaviour of mobile species occurring in close proximity of the turbine. Phase 1a is operational since 2017. It involves four turbines of 1.5MW each. In 2017, Marine Scotland granted consent to install Phase 1b which comprises four more turbines (6MW), in addition to the four turbines already installed.[167] Phase 1b will be installed in 2018. Phase 1c aims to install a further 10 turbines bringing the total capacity of Phase 1 to 86MW. Deployment of Phase1c is

[164] See further: Marine Scotland, Decision Letter Consent and Conditions (September 2013). <https://www.gov.scot/Topics/marine/Licensing/marine/scoping/MeyGen/DecisionLetter> (accessed 20 June 2018), at 25

[165] Marine Scotland, Appropriate Assessment (September 2013). <https://www.gov.scot/Topics/marine/Licensing/marine/scoping/MeyGen/AppropriateAssessment> (accessed 20 September 2018), at 90-91

[166] Ibid, 77

[167] Marine Scotland, Decision Notice – commencement of Phase 1(b) (June 2017). <https://www.gov.scot/Topics/marine/Licensing/marine/scoping/MeyGen/DN-Phase1b-092017> (accessed 2 September 2018)

intended to take place in 2021-2022. The last phase will include the full operational phase and installation of the last set of turbines, which, subject to grid connection, should generate the capacity currently permitted under the seabed lease of 398MW of tidal stream capacity.

4.3.2.2 SeaGen Tidal Energy Turbine, Strangford Lough

SeaGen is the world's first full-scale and grid-connected tidal stream energy turbine.[168] Deployment of SeaGen in Strangford Lough (Northern Ireland) was heralded by the consenting authority and the developer as taking an AM approach.[169] Strangford Lough is highly designated as a SPA under the Birds Directive, a SAC under the Habitats Directive and a Ramsar site. The area is also subject to national designations. The environmental assessment process identified a number of receptors (i.e. marine mammals, benthic ecology, tidal flow and energy) for which the nature and intensity of potential adverse impacts were uncertain. The main concern was whether the turbine would have an adverse impact on the usage of the Lough by harbour seals (*Phoca vitulina*), a qualifying feature of the Strangford Lough SAC.[170] There was also a potential risk of potential impact on grey seals (*Halichoerus grypus*) and harbour porpoises (*Phocoena phocoena*). Although not a qualifying species of the SAC, harbour porpoises are listed in Annexes II and IV of the Habitats Directive, which means they

[168] Graham Savidge and others, (2014), 'Strangford Lough and the SeaGen Tidal Turbine' in Shields M.A, Payne A.I.L., (eds.) *Marine Renewable Energy Technologies and Environmental Interactions* (Springer, 2014), 153

[169] Le Lièvre C., O'Hagan A.M, Culloch R. Bennet F., (2016). Legal Feasibility of implementing a risk-based approach and compatibility with Natura 2000 network. Deliverables 2.3 & 2.4 RiCORE project. at 53, 36

[170] Keenan G., Sparling C., Williams H., Fortune F., (2011). SeaGen Environmental Monitoring Programme: Final Report. Report by Royal Haskoning. pp.81. Available at <https://tethys.pnnl.gov/publications/seagen-environmental-monitoring-programme-final-report> (accessed 4 October 2018), at 13

are subject to a strict protection regime prohibiting death, injury and disturbances. The key aspect of the AM process was therefore focused on marine mammals.

A licence for installation and operation was granted in 2005 to Marine Current Turbines Ltd (MCT) and the installation of the device took place in 2008. The licence was conditional upon the undertaking of several monitoring programmes comprising sonar monitoring, seal telemetry studies, marine mammal observation, shoreline visual surveys and aerial surveys.[171] Conservation objectives relating to harbour seals include inter alia, the maintenance of the numbers of adults at 200 individuals in the Lough.[172] Therefore, the monitoring objectives for marine mammals include, among other things, a zero risk mortality tolerance by reason of physical interactions with the turbine rotors.[173] Associated mitigation measures included operational restriction to daylight operation and the use of Marine Mammal Observers (MMO) who had the ability to shut-down the turbine whenever marine mammals were seen to cross the agreed shut-down action perimeter of 200m. In addition to this, the effectiveness of an active experimental sonar was also trialled as a mitigation measure to assist in the detection of marine mammals.[174] After three years of post-installation monitoring, it was found that marine mammals were not going to collide with the turbine in the pre-agreed shut-down action perimeters. Based on these findings, the precautionary shut down distance was progressively reduced from an excessive 200m to 100 m and then, to less than 30m.[175] Unfortunately, although a short trial removal of the shutdown protocol has been authorised, final removal of shutdown requirements has never been implemented due to

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[171] Ibid, 21-22
[172] Department of Agriculture, Environment and Rural Affairs, (2015). Strangford Lough SAC Conservation Objectives. <https://www.daera-ni.gov.uk/publications/reasons-designation-special-area-conservation-strangford-lough> (accessed 15 November 2017), 61-62
[173] Ibid, 14-18
[174] Savidge and others, (n168), 158
[175] Ibid.

a lack of sufficient time before decommissioning.[176] Monitoring data has nonetheless demonstrated that active sonar was effective in mitigating collision risks, in a manner comparable with MMOs.[177] MMOs were fully replaced by the active sonar which allowed the turbine to be operated on a 24 hour basis.[178] The AM process allowed MCT to operate the SeaGen turbine over a period of five years hence, 'increasing confidence in the technology and demonstrate its capacity to export to the grid'.[179] Overall, the SeaGen project also demonstrated that an AM approach can be successfully applied at the scale of a single turbine to reduce uncertainty while mitigating risks thereby, giving greater confidence to the regulator. The turbine is now being decommissioned by SIMEC Atlantic Energy.[180]

4.3.2.3 Cobscook Bay Tidal Energy Project, Maine, United States

Using conditional licensing, with AM as a basis, Ocean Renewable Power Company (ORPC) was granted a Pilot Project Licence by the Federal Energy Regulation Commission (FERC) in 2012 to develop a 750KW tidal energy project in Cobscook Bay, Maine. One of the initial conditions attached to the licence included the restriction of pile-driving activities during the active season of Atlantic salmon. Mitigation measures during pile-driving operations were also required by the National Oceanographic and Atmospheric Administration (NOAA) to mitigate the impact on Atlantic salmon smolt during the active season. An Adaptive Management Plan (AMP)

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[176] Frank Fortune, (2017) 'Adaptive Management: A tidal stream example from the UK' (ETIPOCEAN Webinar: Adaptive Management Systems – Don't make the same mistakes twice! 13 December 2017). Available at <https://www.etipocean.eu/events/webinar-5/> (accessed 4 October 2018)
[177] Savidge and others, (n168), 158
[178] Ibid.
[179] Fortune, (n176)
[180] Strangford Lough and Lecale Partnership, 'SeaGen Decommissioning Update' *News* (Monday 6 August 2018). <http://www.strangfordlough.org/news/seagen-decommissioning-update-2.html> (accessed 16 August 2018)

has been developed as a requirement of the Pilot Licence.[181] Environmental studies and monitoring plans laying down the foundation for the AM approach were prepared based on consultation with federal and State agencies, scientists and local stakeholders. Monitoring activities encompassed an acoustic monitoring plan, a benthic and biofouling monitoring plan, a marine mammal observation plan and fisheries and marine life interaction monitoring plans.[182]

The licence stipulates that alleviation of the restriction was dependent upon the results of a comprehensive monitoring programme agreed upon by an Adaptive Management Team. The monitoring programme collected data on the propagation of noise, abundance and distribution of key receptors using different monitoring methods including hydro acoustics and air acoustic measurements, marine mammal observations, seabird surveys.[183] On the basis of data collected, ORPC requested a modification of its licence conditions. FERC granted a licence modification to remove the Phase 1 restrictions on pile-driving based on mitigation and acoustic measurements. The Cobscook Bay tidal energy project provides an example of how AM may be operated to relax licensing conditions as more data becomes available over time. The extent to which mitigation measures will be alleviated varies depending on the receptor concerned. Generally speaking, a licence modification includes the removal of restrictions or a reduction of monitoring requirements based on increased knowledge about species presence and potential impacts.[184]

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[181] ORPC Maine, (2012) Cobscook Bay Tidal Energy Project: Adaptive Management Plan. Report by Ocean Renewable Power Company (ORPC), pp.21

[182] Ibid, at 7-12

[183] Ibid, at 8-12

[184] Nathan Johnson, (2016) Ocean Renewable Power Company: Adaptive Management webinar (Thetys, Annex IV Webinar 7). <https://tethys.pnnl.gov/events/adaptive-management-marine-renewable-energy-industry-webinar> (accessed 1st October 2018)

4.3.2.4 The DeltaStream demonstration project, Ramsay Sound, Wales

DeltaStream is a grid-connected tidal stream turbine installed in Ramsay Sound, off the Pembrokeshire coast, Wales. Licence for installation and operation was granted in 2011. The turbine was successfully deployed in 2015. The Pembrokeshire waters are designated as a SAC under the Habitats Directive. Habitats and species of primary concerns include breeding grey seals. Similar to the Meygen project, the licence is conditional upon the implementation of a monitoring programme to understand potential collision risks with marine mammals. A detailed 'Collision Monitoring and Adaptive Management Plan' (CMAMP) has been developed to discharge the conditions of the licence.[185] The CMAMP sets out the approach to marine mammal collision monitoring during the operational phase. Collision monitoring includes a passive acoustic monitoring system comprising several hydrophones directly deployed on the device and an active acoustic monitoring system to detect animals approaching the device rotors.[186] Initial monitoring results at DeltaStream have shown that marine mammals are able to detect and avoid the turbine, albeit these findings cannot be generalised to all tidal energy sites.[187]

[185] See further: Tethys, 'Ramsay Sound' (Tethys, 26 June 2017). <https://tethys.pnnl.gov/annex-iv-sites/ramsey-sound> (accessed 5 October 2018)
[186] Chloe E. Malinka and others, 'First in-situ passive acoustic monitoring for marine mammals during operation of a tidal turbine in Ramsay Sound, Wales' (2018) 590 Marine Ecology Progress Series, 247
[187] Ibid.

5 - Adaptive management and the ecosystem approach

5.1. The ecosystem approach

There is a broad consensus, including among legal scholars, whereby AM 'is the only practical way to deliver ecosystem management',[188] a variant of what the author will also refer to as ecosystem approach. As discussed above, ecosystems are not static but dynamic, 'moving targets', with multiple, yet uncertain and unpredictable equilibria.[189] As far back as 1996, Holling and Meffe already argued that 'management has to be flexible, adaptive, and experimental at scales compatible with the scales of critical ecosystem functions'.[190] The most notable endorsement of AM in the context of the ecosystem approach is established under the framework of the Convention on Biological Diversity:[191]

> The ecosystem approach requires adaptive management to deal with the complex and dynamic nature of ecosystems and the absence of complete knowledge or understanding of their functioning. Ecosystem processes are often non-linear, and the outcome of such processes often shows time lags. The result is discontinuities, leading to surprise and uncertainty. Management must be adaptive in order to be able to respond to such uncertainties and contain elements of "learning-by-doing" or research feedback. Measures may need to be

[188] Ruhl J.B., 'Adaptive Management in the Courts' (2005) 95 Minnesota Law Review, 424, 430; Ruhl J.B., 'Taking adaptive management seriously: a case study of the Endangered Species Act '(2004) 52 University of Kansas Law Review, 1249 1263; Craig R. Allen, Joseph J. Fontaine, Ahjond Garmestani, 'Ecosystems, Adaptive Management (2013) Nebraska Cooperative Fish & Wildlife Research Unit -- Staff Publications, 128
[189] Holling and Meffe, (n24), 332
[190] Ibid.
[191] Convention on Biological Diversity (adopted 5 June 1992, entered into force 29 December 1993) 1760 UNTS 79

taken even when some cause-and-effect relationships are not yet fully established scientifically.[192]

In a similar vein, the Guidelines on the Ecosystem Approach[193] state that an ecosystem approach requires a management approach that is flexible and adaptive, both as a response to changing circumstances and to take account of new knowledge and understanding.[194]

Providing a legal or scientific definition of 'ecosystem approach' or 'ecosystem-based approach' is a difficult task.[195] There is no formally agreed definition of the 'ecosystem-based approach'.[196] At first glance, the ecosystem approach finds its origins in international law. The 1992 Rio Declaration acknowledges the 'integral and interdependent nature of the Earth' and proclaimed States' duty 'to cooperate to conserve, protect, and restore the health and integrity of the Earth's ecosystems'.[197] The approach has also been implicitly endorsed in hard (legally binding) international law under the 1980 Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR),[198] the 1982 Convention on the Law of the Sea (UNCLOS),[199] the Convention on Biological Diversity (CBD), and the 1997 Convention on Non-Navigational Use of International Watercourses.[200] Whilst it goes beyond the scope of this study to review all these instruments, it is worth noting the ecosystem approach has

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192 Fifth Meeting of the Conference of the Parties, COP Decision V/6 'Ecosystem Approach' (15-16 May 2000, Nairobi, Kenya); Seventh Meeting of the Conference of the Parties, COP Decision VII/11'Ecosystem Approach' (9-20, 27 February 2004, Kuala Lumpur), para. 4

193 Secretariat of the Convention on Biological Diversity (2004) The Ecosystem Approach, (CBD Guidelines) Montreal: Secretariat of the Convention on Biological Diversity, at 50

194 Ibid.

195 Ronan Long, 'Legal aspects of Ecosystem-Based Marine Management' in Chircop A., McConnell M.L., Coffen-Smout S., (eds.) Ocean Yearbook vol. 26 (Boston/ Leiden, Brill Academic Publishers, 2012), 417

196 Ibid, 419

197 Declaration on the Environment and Development (UNGA, Doc. A/CONF.151/26/Rev.1), Principle 7

198 Convention on the Conservation of Antarctic Marine Living Resources (adopted 20 May 1980, entered into force 7 April 1982) 1329 UNTS 48 (CCAMLR)

199 United Nations Convention on the Law of the Sea (adopted 10 December 1982, entered into force 16 November 1994) 1833 UNTS 397 (UNCLOS)

200 Convention on the Law of the Non-Navigational Uses of International Watercourses (adopted 21 May 1997, entered into force 17 August 2014) 36 ILM 700

been adopted as the primary framework for the conservation and sustainable use of biodiversity under the CBD.[201] As such, it is under the framework of the CBD that the most recognised definition of this notion has been given.[202] An ecosystem approach is defined in Decision V/6 as 'a strategy for the integrated management of land, waters and living resources that promotes conservation and sustainable use in an equitable way'.[203] Decision V/6 also provides that implementing an ecosystem-based approach to management demands the use of 'appropriate scientific methodologies' that are 'focused on the levels of biological organization, which encompass the essential structure, processes, functions and interactions among organisms and their environment'.[204] This means that management ought to be designed to match the scales of the aspects of the ecosystem being managed.[205] Again, the framework of the CBD offers 12 complementary and interlinked Principles, the so-called Malawi Principles, to facilitate the implementation of this approach.[206] Many of the Principles refer to the need to manage ecosystems within the limits of their functioning (Principle 6), to take into account all form of knowledge about ecosystems (Principle 11) in order to conserve ecosystems' structures and functioning (Principle 5), and to decentralise resource management in a way that matches the spatial and temporal scale of the ecosystem being managed (Principles 2 and 7) with long-term objectives for ecosystem management underpinning temporal scales and lag-effects of ecosystem processes (Principle 8). The need for AM is emphasised in Principle 9. Recognising that abrupt and unpredictable changes in dynamic natural resources are inevitable, 'the ecosystem

[201] COP Decision II/8 'Preliminary consideration of components of biological diversity particularly under threat and action which could be taken under the Convention' (6-17 November 1995, Jakarta), para.1
[202] COP Decision V/6 'Ecosystem Approach', section A, para.1; COP Decision VII/11 'Ecosystem Approach, Annex I (A) (1)
[203] Ibid.
[204] Ibid.
[205] COP Decision V/6 'Ecosystem Approach', section B, para. 6; COP Decision VII/11 'Ecosystem Approach', Annex B.
[206] Ibid.

approach must utilize adaptive management in order to anticipate and cater for such change'.[207]

In light of these constitutive principles, management envisioned under the ecosystem approach should rely on the best scientific knowledge and aim to embrace, rather than control, ecosystems' dynamics. Similar thinking is evident from the working definition of the International Council for the Exploitation of the Sea (ICES) and the Bremen Statement of the Joint Ministerial Meeting of the OSPAR and Helsinki Commissions: the 'ecosystem approach could be described as the comprehensive integrated management of human activities based on the best available scientific knowledge about the ecosystems and its dynamic, in order to identify and take actions on influences which are critical to the health of marine ecosystems, thereby achieving sustainable use of ecosystem goods and services and maintenance of ecosystem integrity'.[208]

Further, the ecosystem approach is the topic of ripe doctrinal analysis. DeLaplante[209] and Vito De Lucia consider the ecosystem approach as a methodology applying ecosystem principles to a variety of fields and disciplines.[210] As a methodology, the ecosystem approach entails a 'metaphor for holistic [system] thinking' requiring 'an expanded consideration of the dynamic and complexity of ecological systems'.[211] In a similar line of thought, the ecosystem approach would support what Tallacchini refers to as 'ecological normativity', i.e. a framework where legal norms are aligned with the

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207 Ibid.

208 International Council for the Exploitation of the Sea, (2005). Guidance on the Application of the Ecosystem Approach to Management of Human Activities in the European Marine Environment. ICES Comparative Research Report No.273. p.4; Statement on the Ecosystem Approach to the Management of Human Activities, First Joint Ministerial meeting of the Helsinki and OSPAR Commissions (JMM) Bremen, 25–26 June 2003, para.5

209 Kevin DeLaplante, 'Is Ecosystem Management a Postmodern Science?' in Cuddington K.E. and Beisner B.E. (eds.) *Ecological Paradigms Lost: Routes of Theory Change* (Academic Press, 2005), 397, 398

210 Vito De Lucia, 'Competing Narratives and Complex Genealogies: The Ecosystem Approach in International Environmental Law' (2015) 27 Journal of Environmental Law, 91, 98

211 Steven L. Yaffee, 'Three Faces of Ecosystem Management' (1999) 13 (4) Conservation Biology, 713, 713

ecological description.[212] From there, an ecosystem-based approach presupposes that intrinsic ecosystem properties, including resilience principles, are firmly accounted for in legal terms and in management practices. More generally, the tenets of the ecosystem approach underscore the need to manage ecosystems within the limits of their functioning and demand both the integration of best scientific knowledge and a holistic, 'integrated' approach to managing human concerns in order to protect ecosystems' integrity.[213] For Trouwborst, this calls for an adaptive management process, 'tailored to the ecosystem at hand'.[214]

As Morgera points out, few authors have reflected on the interactions of the ecosystem approach and the precautionary principle in light of adaptive management.[215] Trouwborst argues that the ecosystem approach and the precautionary principle are 'independent concepts, which at the same time are intrinsically linked'.[216] Both 'embody response to the failure of reactive, ad hoc approaches to environmental protection and management, [traditionally associated witch command and control], and are products of the little contested view that these approaches are to be turned into holistic ones'.[217] While the ecosystem approach and the precautionary principle serve different functional purposes,[218] both have a complementary role to play in protecting ecosystems' integrity by maintaining the level of anthropogenic pressures within sustainable ecological limits or thresholds. In the words of Raitanen, both the ecosystem approach and the precautionary principle 'can be considered to be the basic features of a

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[212] Tallacchini, 'A legal framework from ecology', (n78), 1089
[213] Froukje M. Platjouw, *Environmental Law and the Ecosystem Approach: Maintaining ecosystem integrity through consistency in law* (1st edn, Routledge 2016), 220
[214] Trouwborst, 'The Precautionary Principle and the Ecosystem Approach', (n115), 28
[215] Elisa Morgera, 'The ecosystem approach and the precautionary principle' in Morgera E., Razzaque J., (eds.) *Biodiversity and Nature Protection Law* (1st edn, Edward Elgar, 2017), 76
[216] Trouwborst, (n115), 35
[217] Ibid, 26
[218] The ecosystem approach demands a holistic, integrated approach to managing human activities to maintain cumulative pressures within the limits of ecosystems' functioning hence, enabling sustainable provision of ecosystem services. The precautionary principle is a response to scientific uncertainty.

sustainable use of natural resources'.[219] This brings us back to the narrative on 'ecological sustainability',[220] which as discussed in Chapter V, constitutes the core ecological limits [of ecosystem functioning] within which human development can thrive and still be sustainable.

'While there is a need to accelerate efforts to gain new knowledge about functional biodiversity', it is acknowledged that ecosystem management has to be carried out even in the absence of such knowledge'.[221] From an ecosystem approach perspective, the precautionary principle reminds us that scientific knowledge and understanding of functioning of natural ecosystems is never perfect due to their inherent complexity. In the face of limited knowledge and information, the role of the precautionary principle, within an ecosystem-based approach, is to prescribe prudent and conservative measures to avert any undue impingement on ecosystems' ecological integrity.[222] From there, Trouwborst rightly observes that 'the precautionary principle is an integral component of the ecosystem approach'.[223] In effect, taking an ecosystem approach entails 'acting with caution where knowledge is lacking or, put in another way, implementing adaptive management abiding by the maxim: the more incomplete the knowledge, the more precautionary planning and management'.[224] Against this backdrop, while precautionary principle is an integral component of the ecosystem-based approach,[225] AM complements the precautionary principle by incorporating scientific knowledge of critical ecological limits. This finding is well entrenched by the Conference of the Parties to the CBD which states:

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[219] Raitanen, 'Legal weaknesses and windows of opportunity in transnational biodiversity protection', (n95), 81, 97

[220] In Chapter V, section 3.2, the author argues that 'ecological sustainability' constitutes the ecological core of sustainable development in that it refers to the capacity of natural ecosystems to sustain biological life and provide ecosystem services for durable human societies.

[221] COP Decision V/6 'Ecosystem Approach', section C, para.1

[222] Trouwborst, (n115), 33

[223] Ibid, 34

[224] *Report of the Work of the United Nations Open-Ended Informal Consultative Process on Ocean and the Law of the Sea at its Seventh Meeting* (New York, 12-16 June 2006, ICP-7 Report), para.54

[225] Trouwborst, (n115), 33

> 'There are fundamental limits to the levels of demand that can be placed on ecosystems while maintaining its integrity. Our current understanding is insufficient to allow these limits to be precisely defined, and therefore a precautionary approach coupled with adaptive management, is advised'.[226]

From an ecosystem approach perspective, adaptive management and the precautionary principle should be considered as complementary to manage natural ecosystems and conserve their integrity in the face of scientific uncertainty. Tarlock follows along the same line when arguing that adaptive management would 'correct the bias of the precautionary principle towards no action in the face of uncertainty and the opposite bias for immediate fixes unconnected to long-term monitoring, assessment and adjustment to changed conditions and information'.[227]

[226] COP Decision V/6, section C, para.1; COP Decision VII/11, Annotations to the rationale of Principle 6

[227] Dan Tarlock, 'Ecosystems' in Bodansky D., Brunée J., Hey E., (eds.) *The Oxford Handbook of International Environmental Law* (Oxford University Press, 2014), 581

5.2. Adaptive management: a resilience-based management approach

Managing for resilience presupposes demands anticipating, detecting and managing critical ecological thresholds leading to undesirable regime shifts.[228] The identification of ecological thresholds is a 'difficult task' which is 'fraught with significant uncertainty'.[229] This is however an essential prerequisite for ecosystem-based management. Mackinnon and others explain that thresholds represent the maximum degree to which the receiving ecosystem can be altered and still deemed sustainable.[230] Thresholds are also regarded as 'the boundaries of a system's "safe operating space", in which risk of unwanted regime shift is low and resilience is high'.[231] Failure to incorporate this information into management has often led to unsustainable outcomes with severe loss of ecosystem services such as fisheries collapses.[232] Environmental management that is capable of proactively detecting and avoiding critical thresholds is increasingly regarded as more inclined to avert dramatic consequences associated with undesirable regime shifts.[233] This however cannot be successfully achieved in the absence of science and scientifically-derived monitoring data.[234] Kelly and others argue that the primary way thresholds are being addressed in planning and permitting decision-making has been retrospective, after the threshold is crossed.[235] This failure has been attributed to limited understanding of those factors triggering threshold dynamics.[236] It is precisely the existence of uncertainty surrounding regime shifts that

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228 Philip S. Levin and Christian Mölmann, 'Marine ecosystem regime shifts: challenges and opportunities for ecosystem-based management' (2015) 370 Philosophical Transactions of the Royal Society, 1

229 Ahjond S. Garmestani, and others, 'The Integration of Socio-Ecological Resilience and Law' (2014) Nebraska Cooperative Fish & Wildlife Research Unit – Staff Publication 144, 374

230 MacKinnon, Duinker and Walker, (n4), 45

231 Selkoe and others, (n48), 10

232 Yan Jiao, 'Regime shifts in marine ecosystems and implications for fisheries management, a review' (2009) 19 Review in Fish Biology and Fisheries, 177

233 Ryan P. Kelly and others, 'Embracing thresholds for better environmental management' (2015) 370 Philosophical Transactions R. Soc., 1; Foley and others, 'Using Ecological Thresholds to Inform Resource Management', (n49), 1-12

234 Craig R. Allen and others, 'Managing for resilience' (2011) 17 (4) Wildlife Biology, 337, 342

235 Kelly and others, (n233), 1

236 Foley and others, (49), at 1-2

has driven the development of AM practices.[237] AM has been advocated as an essential resilience-based management approach because of its focus 'on learning, reducing uncertainty and monitoring'.[238] Similar to the resilience theory, AM acknowledges that ecosystems can exist under multiple yet uncertain alternative regimes and builds adaptive capabilities accordingly by providing the monitoring framework to 'reduce uncertainty' about threshold dynamics as well as the iterative management framework to proactively avoid critical threshold crossing.[239] The framework of AM typically breaks with the pathologic 'command-and-control' paradigm and mimics the adaptive cycle of Panarchy. Similar to Panarchy, the cycle of AM includes a back-loop phase of implementation and monitoring, evaluation and reorganisation (figures 1 and 2). However, instead of allowing for decreased resilience in the Panarchy cycle, AM incorporates an iterative process to proactively detect and avert threshold approaches. As interventions are carried out, monitoring data 'provide opportunities for identifying and recalibrating thresholds, thereby reducing uncertainty'.[240] Green and others clarify this point by arguing that AM plans should be tailored to accommodate uncertainty as monitoring data help identify critical thresholds.[241] If monitoring results show that an unwanted threshold is being approached, management actions are warranted to avoid threshold crossing. Ecological thresholds can thus be 'recalibrated in an iterative manner'[242] as new information from ecosystem monitoring show progress towards an undesirable threshold/tipping point.[243] Hence, linking the iterative phase of AM to specific thresholds is increasingly regarded as 'an effective tool' that holds great

[237] Berckley and Gunderson, (n9), 202
[238] Williams, Szaro and Shapiro, 'Adaptive Management: The US Department of the Interior Technical Guide', (n118), 4
[239] Craig R. Allen and others, (n234), 337, 342
[240] Olivia O. Green and others, 'Barriers and bridges to the integration of socio-ecological resilience and law' (2015) 13 (6) Frontiers in Ecology and the Environment, 332, 334
[241] Ibid.
[242] Garmestani and others (n229), 374
[243] Ibid.

promise for maintaining resilient ecosystems[244] and delivering ecosystem management.[245] Garmestani and others argue that AM provides a useful framework to learn about dynamic ecosystems in a way that is 'safe-to-fail', namely, 'in a manner that is unlikely to push these systems over a tipping point'.[246] Some environmental scientists and managers may already be familiar with this process on the ground. Karr and others found that the use of quantitative thresholds linked to adaptive harvest control offers a powerful way to deliver precautionary and ecosystem-based fishery management in Caribbean coral reefs.[247]

Although managing for resilience is data intensive[248] and should typically be led at the strategic ecosystem-level, there is no reason why the principles of resilience and AM could not also be applied at the project-level to better manage scientific uncertainty regarding the implications of ORE for the integrity of N2000 sites. Kelly *et al*., have recently found that smaller ecological systems such as marine protected area would be more amenable to threshold-based AM where routine monitoring is implemented to track and control undesirable thresholds.[249] N2000 sites may thus be appropriate ecological fora to implement the mechanisms of threshold-based AM. The Birds and Habitats Directive are not explicitly threshold-based but they become so as their implementation requires the achievement of Favourable Conservation Status (FCS) and the definition of conservation objectives for designated N2000 sites. Conservation objectives dictate the notion of 'adverse effect on the integrity' of N2000 sites[250] and as such, site-specific conservation objectives may provide useful benchmarks against

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244 Craig R. Allen and others, (n234), 343; Garmestani and others, (n229), 374; Kelly and others, (n233), at 7-9

245 Melissa Benson, Courtney Schultz, 'Adaptive Management and Law' in Allen C.R, Garmestani A.S. (eds.), *Adaptive Management of Socio-Ecological System* (Dordrecht: Springer 2015), 40

246 Garmestani and others, (n229), 371

247 Kendra Karr and others, 'Thresholds in Caribbean coral reefs: implications for ecosystem-based fishery management' (2015) 52 Journal of Applied Ecology, 402

248 Selkoe and others, (n48), 7

249 Kelly and others, (n233), 1

250 European Commission, 'Methodological Guidance on the Provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC' (2002), at 40

which a threshold-based approach to AM can be utilised to deploy and manage ORE projects within the limits of the integrity of N2000 sites. In the context of the Habitats Directive, 'threshold-based' AM would allow for iterative adjustment of ORE deployments as new empirical information collected through routine monitoring indicate that an acceptable threshold of change or impact is being approached. Regulatory decision-makers can thus consent ORE developments despite remaining uncertainty and review permitting conditions on the basis of monitoring data with the goal of avoiding pre-identified thresholds of 'acceptable' harm on N2000 features. To date, impact thresholds are more commonly used in pre-consent procedures to define the acceptability of projected OWF impacts.[251] Where thresholds were introduced in consenting processes, AM is however rarely implemented to refine their accuracy and adjust mitigation actions and monitoring accordingly.[252] In some cases, comprehensive monitoring around consented OWFs did not exceed three years following construction.[253]

[251] Jens Lüdeke, 'Offshore Wind Energy: Good Practice in Impact Assessment, Mitigation and Compensation' (2017) 19 (1) Journal of Environment Assessment policy and Management, 1
[252] Hanna and others, (n15)
[253] Matthew Ashley and others, 'Co-locating offshore wind farms and marine protected areas: A United-Kingdom perspective' in Yates K.L., Bradshaw J.A., (eds.) *Offshore Energy and Marine Spatial Planning* (Routledge, 2018), 246, 256

6- An interim methodological framework for adaptive management under the Habitats Directive

6.1. 'How much is too much?' setting the thresholds of 'acceptable' changes/impacts

The implication of a proposed development for the site's conservation objectives assists in determining whether the development will have lasting adverse effects on the integrity of a site. The EC revised guidance document indicates that the determination of adverse impact on the site's integrity should be focused on, and be limited to, the site's conservation objectives.[254] The 'integrity checklist' of the methodological guidance on Articles 6(3) and (4) further stipulates that the integrity test involves *inter alia* determining whether a development has the potential to 'cause delays' or 'interrupt' 'progress towards achieving the conservation objectives of the sites'.[255] No further indication is given regarding how 'large' a predicted impact on a N2000 site and its qualifying features must be for the integrity of the sites to be adversely affected.[256] The CJEU partially answered this question in the *Sweetman* case[257] but at the same time opted for a purposive approach to interpretation of 'site integrity' which deviates from scientific understanding of this concept.[258] In light of the EC guidance documents and CJEU jurisprudence, the critical consideration in relation to the integrity test of Article 6(3) is whether the predicted direct and indirect impacts of a proposed development on protected species and habitats and, or the ecological characteristics of N2000 sites that are connected to the presence of these species or natural habitats will be such that the

[254] European Commission, 'Managing Natura 2000 sites. The provisions of Article 6 of the Habitats Directive' (Commission notice) C (2018)7621, at 40
[255] European Commission, (2002), (n250), at 28
[256] Rhys E. Green and others, 'Lack of sound science in assessing wind farm impacts on seabirds' (2016) Journal of Applied Ecology, 1635, 1639
[257] Case C-258/11 *Sweetman and Others v. An Bord Pleanála* [2013] ECLI:EU:C: 2013:220, para. 48
[258] Chapter IV, section 3.1

proposed development will undermine the site's ability to achieve its conservation objectives.[259]

Taking an AM approach requires tolerance thresholds of change/harm. The framework for AM should first involve defining strategic thresholds of acceptable change having regard to the specified conservation objectives of N2000 sites. At the strategic level, thresholds are formulated as the maximum precautionary levels of cumulative changes/impacts that a N2000 site and its qualifying features (species or habitats) can reasonably incur without adversely affecting the capacity of a N2000 site to achieve its conservation objectives and as such, the site's contribution to the objective of FCS. Strategic thresholds of acceptable harm/changes are site-specific and must be informed by its conservation objectives, species ecology and species conservation status (i.e. favourable, declining).[260]

Strategic thresholds should in turn be used to inform project-specific thresholds. At the project-level, thresholds of acceptable changes/impacts are values to be avoided throughout the life time of a consented project. These thresholds will determine the 'safe operating space'[261] within which ORE projects can be approved and operated under uncertainty in compliance with the specified conservation objectives of N2000 sites. At the project level, a 'threshold' determines the maximum level of changes a proposed development can cause to the receiving ecosystem. If an AA is deemed necessary, the first step for project developers is to submit a Natura Impact Statement (NIS) to support the findings of an AA. NIS must identify the implications of the project for N2000 species and habitats concerned and be transparent on the nature of

[259] Paul M. Thompson and others, 'Framework for assessing impacts of pile-driving noise from offshore wind farm construction on harbour seal population' (2013) 43 Environmental Impact Assessment Review, 73

[260] Elizabeth R. Hawkins and others, 'Best practice framework and principles for monitoring the effect of coastal development on marine mammals' (2017) 4 Frontiers in Marine Science, 1

[261] Johan Rockström and others, 'Planetary Boundaries: Exploring the Safe Operating Space for Humanity' (2009) 14(2) Ecology and Society, 1

uncertainty surrounding these threats. In the initial set up phase, development consent must be contingent upon developer, regulator and an independent advisory body agreeing upon the content of an Environmental Management Plan (EMP). The EMP is designed to ensure that the potential impacts resulting from the development will remain compatible with the strategic thresholds adopted for the site concerned. To do so, the EMP should be as detailed as practical and be explicit on how uncertainty is to be responded to at all development stages. In particular, the EMP should contain a detailed monitoring programme together with clearly defined thresholds triggering the adoption of corrective mitigation measures.

The specifics of the framework have to be adapted to each receptor and the impact pathways of each technology. For example, collision risks are predominantly an issue for devices with exposed rotor blades such as tidal energy turbines. On the other hand, disturbances from acoustic noise, electro-magnetic fields and barrier effect of multiple turbines are common issues to all type of technologies including offshore wind farms as well as wave and tidal energy devices deployed in arrays. The nature of impacts, either direct/lethal (i.e. collision, entanglement, hearing damages) or indirect/non-lethal (e.g. disruption of behaviour) determine the nature of thresholds of acceptable change/impacts as well as relevant indicators for threshold detection in monitoring programmes. With respect to lethal impacts (collision risks), if one considers that every collision leads to injury and death, then a decline in population is expected. Here, the threshold of acceptable impact can be formulated as a maximum level/number of mortalities from collisions that a species population can sustain without adversely impacting its stability. An adaptive management and collision plan based on 'thresholds' of acceptable collisions of marine mammals has recently been developed to consent the single DeltaStream tidal turbine in a SAC designated for breeding seals (section 4.3.2.4).[262] The objective is to reduce uncertainty surrounding encounter/collision rates while ensuring that collisions do not breach species-specific thresholds.[263] If these thresholds are met or approached, further mitigation would be required to mitigate risks of harmful impacts.[264]

With regard to the non-lethal impacts of disturbances from acoustic noise and barrier effect, the process is more complex. Displacement of foraging or migrating animals may have chronic effects on health, survival and reproduction (vital rates) if animals expend more energy to avoid the source of disturbance or reach alternative and potentially less profitable foraging habitats.[265] Similarly, Permanent Threshold Shifts (PTS) or Temporary Threshold Shift (TSS) resulting from exposure to acoustic noise may have chronic effect on reproduction and survival if it reduces animal capacity to detect their predator, to locate and capture their prey.[266] If a sufficient number of animals are exposed, this may affect demographic rates and lead to population decline. If the population declines, a significant effect on the sites' conservation objectives and hence, on the integrity of the site will occur. In this context, acceptable thresholds may be formulated as, for example, 1) a maximum level of animal displacement above which an animal's energy intake and vital rates will be adversely affected; 2) maximum thresholds of habitat loss, 3) maximum decrease in prey availability as a result of project disturbance; 4) maximum levels of underwater noise above which acoustic disturbance is projected to cause PTS or TSS. Threshold values for impulsive piling

[262] Tethys, 'Ramsay Sound' (n185)

[263] Andrea Copping and others, (2016). Annex IV 2016 State of Science Report: Environmental Effects of Marine Renewable Energy Development Around the World. pp.224. at 41

[264] Sparling C.E., Thompson D., Booth C.G., (2017) Guide to Population Models used in Marine Mammal Impact Assessment. (JNCC Report No. 607. JNCC, Peterborough), 8

[265] Jacob Nable-Nielsen and others, 'Effects of noise and by-catch on a Danish harbour porpoise population' (2014) 272 Ecological Modelling, 242; Frederik Christiansen and David Lusseau, 'Linking Behaviour to Vital Rates to Measure the Effects of Non-Lethal Disturbance on Wildlife' (2015) 8(6) Conservation Letters, 424; Busch M., Garthe S., 'Approaching population thresholds in presence of uncertainty: Assessing displacement of seabirds from offshore wind farms' (2016) 56 Environmental Impact Assessment Review, 31

[266] John Harwood and Stephanie King, (2017). The Sensitivity of UK Marine Mammals Populations to Marine Renewables Developments (Revised Version. Report number SMRUC-MSS-2017-005). <https://data.marine.gov.scot/node/931/revisions/5706/view>, (3 March 2017), at 9

noise already exist. For example, in Belgium and Germany, acceptable thresholds for marine mammals shall not exceed 185dB and 160Db respectively, at a distance of 750m from the piling site.[267]

A key challenge for scientists and regulators is to determine the thresholds of risk that are 'acceptable' having regard to statutory conservation objectives. The exact location of acceptable thresholds is often unknown or difficult to quantify with certainty. Such a level of 'acceptable risk' is not prescribed in law nor can it be derived from case law and accordingly must be determined on a case-by-case examination of conservation status. To date, the notion of ecological thresholds is still more a scientific concept than a tangible conservation tool. Johnson stresses that uncertainty and the lack of clear and consistent methods for identifying thresholds and appropriate response variables are practical limitations to the use of thresholds as regulatory limits.[268] Identification of acceptable risks cannot therefore rely on science alone.[269] Trade-offs between conservation and ORE developments must be based on social values through participatory decision-making processes. Until there is a better empirical understanding of impact pathways and the consequences of these on a species population, precautionary margins in the form of conservative thresholds must be adopted to acknowledge the extant levels of uncertainty. The size of precautionary margins should be informed by a number of factors including social acceptance and risk appetite of regulators and stakeholders, the conservation value of the affected species and the levels of confidence in modelling outputs.

[267] Ursula Verfuss and others, 'Review of offshore wind farm impact monitoring and mitigation with regard to marine mammals' in in Popper A.N., Hawkins A., (eds.*) The Effect of Noise on Aquatic Life II* (New York, Springer, 2015), 1179

[268] Chris J. Johnson, 'Identifying ecological thresholds for regulating human activities: effective conservation or wishful thinking?' (2013) 168 Biological Conservation, 57

[269] Ibid, at 62

The need to ascertain impact thresholds that fully meet the requirements of the Habitats Directive in order to address consenting risks has been identified as a 'high' priority research area by the Scottish Offshore Renewables Joint Industry Partnership (ORJIP).[270] Modelling frameworks that seek to define acceptable thresholds exist and may be used for setting scientifically sound thresholds of acceptable changes/impacts on N2000 features. For example, the 'Potential Biological Removal' (PBR) framework has been used to calculate the threshold of marine mammal collision mortalities in the AM process of the DeltaStream tidal energy turbine.[271] Another approach, the Interim Population Consequence of Disturbance (iPCoD), has been developed to predict the population consequences of noise disturbances on marine mammals during the construction and operation of offshore wind farms.[272] As discussed in Chapter III, iPCoD is subject to significant data limitations and as such, the model heavily relies on expert elicitation to inform its parameters.[273] Scientific initiatives are currently underway to improve these modelling frameworks.[274] Progress in scientific methods will progressively increase the levels of confidence necessary to authorise ORE deployments under AM protocols. Lusseau and others observe that iPCoD may then be well suited to an AM scheme where expert opinions would be progressively replaced by new observational and empirical data from monitoring, thus 'increasing the precision

[270] ORJIP Ocean Energy, (2017). The Forward Look; Ocean Energy Environmental Research Strategy of the UK. Report to: The Crown Estate, Marine Scotland, Welsh Government, Scottish Natural Heritage and Natural Resource Wales (Aquatera Ltd & MarineSpace Ltd, November 2017). <http://www.orjip.org.uk/documents> (accessed 20 March 2018)
[271] Sparling C.E., Thompson D., Booth C.G., (n263), 8
[272] Stephanie L. King and other, 'An interim framework for assessing the population consequences of disturbances' (2015) 6 Methods in Ecology and Evolution, 1150
[273] Christian Donovan and others, 'Expert elicitation methods in quantifying the consequences of acoustic disturbance from offshore renewable energy developments' in Popper A.N., Hawkins A., (eds.) *The Effect of Noise on Aquatic Life II* (Springer Science, 2016), 231
[274] Sarah J. Dolman and others, 'Fulfilling EU laws to ensure marine mammal protection during marine renewable construction operations in Scotland' in Popper A.N., Hawkins A., (eds.) *The effects of noise on aquatic life II.* (Springer Science, 2016), 226

and accuracy of model outputs'.[275] New empirical data must be used to refine 'acceptable' thresholds and review operational projects accordingly.

6.2. Mitigation

AM strategies must be fully integrated into the mitigation hierarchy, which lies at the heart of Article 6 of the Habitats Directive.[276] The mitigation hierarchy is embedded by a sequence of actions to avoid, reduce and minimise the negative impacts and, as a last resort, to compensate for any residual impact.[277] At the top of the mitigation hierarchy, adverse impacts on habitats and species must be primarily avoided by well-informed designated areas for ORE (see conclusion). Where negative impacts cannot be completely avoided through macro-siting, harms must be avoided or reduced by means of genuine mitigation measures, and lastly compensatory measures should be taken to compensate for any residual impact.[278] Mitigation measures must be sought and implemented from the beginning of project implementation and not solely when monitoring data show undesirable trend towards an unacceptable threshold. The strength of mitigation requirements reflects the seriousness and irreversibility of the threat and the level of uncertainty. The more significant and the more uncertain a likely adverse impact, the more precautionary mitigation measures there should be. The aim of an AM process should normally be to progressively remove mitigation constraints where monitoring data indicates that it is appropriate to do so.

[275] David Lusseau and others, 'Assessing the risks to marine mammal populations from renewable energy devices: an interim approach Joint Nature Conservation Committee, Peterborough, Eng. <http://dro.deakin.edu.au/view/DU:30059133>, (18 April 2017), at 15

[276] Case C-521/12 TC *Briels and Others v. Minister van Infrastructuur en Milieu* [2014] ECLI:EU:C: 2014:330, Opinion of AG Sharpston, paras.30-31

[277] Hendrik Schoukens, 'Habitat Restoration Measures as Facilitators for Economic Development within the Context of the EU Habitats Directive: Balancing No Net Loss with the Preventive Approach' (2017) 29 Journal of Environmental Law, 44, 64

[278] European Commission, 'Managing Natura 2000 sites'(n25), 36-37.

A thorough catalogue of all possible mitigation actions goes beyond the scope of this study. At first glance, AM may not be technically feasible with respect to all mitigation measures. As a learning process, the success of AM is contingent upon the capacity of medium/long-term monitoring programmes to provide meaningful information to inform responsive mitigation actions. The temporary nature and severity of impacts associated with construction works, especially during piling operations, may restrict the possible degree to which construction noise mitigation measures can be adapted at the project-level on the basis of monitoring results. The prescription of one-time precautionary mitigation measures may be preferable to maintain construction noise below allowable thresholds of impulsive noise. Available mitigation techniques for OWF noise reduction encompass a number of techniques including the use of 1) acoustic deterrent devices and 'soft start'[279] to ensure that no animal is present in the impact area, 2) low-noise foundation technologies (e.g. floating or gravity-based), 3) monitoring of exclusion zones to delay piling operations on the basis of marine mammal sighting, and 4) large or small bubble curtains and hydro sound dampers.[280]

Post-construction mitigation may consist in spatially arranging turbines layout, a mitigation measure also known as 'micro-siting. Research into micro-siting measures is lacking for OWFs. Onshore, Gartman and others argue that the best way to minimize collision risks consists in avoiding flight corridors, placing turbines parallel to flight patterns and arranging turbines in clusters or rows.[281] Curtailment or temporary shutdowns of turbines operation are also increasingly applied at onshore wind energy

[279] 'Soft start' or 'ramp up' is a noise mitigation technique where the intensity of pile-driving activities is progressively increased to permit marine mammals to leave the zone before maximum noise levels are reached. Bailey and others, 'Assessing environmental impacts of offshore wind farms', (n107), 8

[280] Jens Lüdeke, 'Exploitation of Offshore Wind Energy' in Salomon M., Markus T., (eds.) *Handbook on Marine Environmental Protection* (vols.1 and 2, Springer, 2018), 177

[281] Gartman V. and others, (2016a) 'Mitigation measures for wildlife in wind energy development, consolidating the state of knowledge – Part 1: Planning and Siting, Construction' (2016) 18 (3) Journal of Environmental Assessment Policy and Management, 1, 11

sites to mitigate collision risks with birds and bats at times of high flight density or sensitive migration periods.[282] Whilst such mitigation measures have not yet been fully realised in OWFs,[283] curtailment operations have been trialled in combination with an AM strategy to minimise collision risks for marine mammals at the single SeaGen tidal energy turbine (see section 4.3.2 above). There is an obvious ‘economic cost’ associated with curtailment operations.[284] Likewise, curtailment and temporary shutdowns are arguably sufficient to address all negative impacts, especially those related to avoidance behaviour as a result of noise disturbance and barrier effects, habitat loss and changes in sedimentary regimes. Where a threshold approach under conditional licensing is deemed unfeasible or unacceptable, AM may alternatively be implemented through a staged consenting process whereby projects can be deployed in stages, starting at small scale, and expanding progressively depending on the findings of monitoring. Monitoring should provide meaningful evidence showing that the impacts of larger scale deployments are properly understood and do not exceed acceptable thresholds. An example of phased development is the Meygen tidal energy project – as discussed in section 4.3.2.1. In this vein, AM may for example be useful to inform future numbers and micro-siting of devices.

On-site habitats re-creation/restoration measures have also been envisaged in AM strategies to mitigate the impacts of onshore wind farms.[285] Offshore, the restoration or replacement of biologically similar habitats has also been contemplated for epifaunal

[282] Gartman V. and others, (2016b) ‘Mitigation measures for wildlife in wind energy development, consolidating the state of knowledge – Part 2: Operation, Decommissioning’ (2016) 18 (3) Journal of Environmental Assessment Policy and Management, 1, 13-16
[283] Ibid, 15
[284] Karamvir Singh, Erin D. Backer, Matthew A. Lacker, ‘Curtailing wind turbine operations to reduce avian mortality’ (2015) 78 Renewable Energy, 351
[285] Coelho, Mesquita and Mascarenhas, (n146), 220

species through the re-creation of seagrass meadows or artificial reefs.[286] *In-situ* creation of favourable conditions for artificial reefs and benthic habitats on and around offshore wind turbine together with the reintegration of sessile organisms within the OWFs could be performed and adaptively managed over the duration of the project. However, the legal soundness of this approach and more particularly, the extent to which on-site nature creation/restoration measures can qualify as mitigation under the AA of Article 6(3) is unclear.[287] Mitigation measures must be an integral part of the specifications of the project and must be directly linked to the affected habitats or species. As a matter of principle, the CJEU held that future creation of an area of equal or greater size of the natural habitat type affected, albeit inextricably linked to the project, in another location of the site not directly affected by the project cannot be considered as mitigation under the AA process.[288] This holds true even if habitat creation or restoration measures are implemented prior to the occurrence of possible adverse effects.[289] Off-site/on-site habitat restoration/creation measures may, perhaps, be more easily considered for species subject to strict protection under Article 12(1). The EC Guidance on Strict Species Protection specifies that mitigation measures may include actions that actively improve or manage functional areas through for example, 'enlarging the site or creating new habitats, in, or in direct functional relation to, a breeding or resting place as a counterweight to the potential loss of parts or functions of the site'.[290]

[286] Harold Levrel, Sylvain Pioch, Richard Spieler, 'Compensatory measures in marine ecosystems: which indicators for assessing the "no net loss" goal of ecosystem services and ecological functions' (2012) Marine Policy, 1202

[287] Hendrik Schoukens, 'Habitat Restoration Measures as Facilitators for Economic Development within the Context of the EU Habitats Directive: Balancing No Net Loss with the Preventive Approach' (2017) 29 Journal of Environmental Law, 47

[288] *Briels and Others*, (n276), para.30

[289] Joined Cases C-387/15 and 388/15 *Hilde Orleans and Others v Vlaams Gewest* [2016] ECLI:EU:C:2016:583

[290] European Commission, 'Guidance document on the strict protection of animal species of Community interest under the Habitats Directive 92/43/EEC' (2007), at 47-48

6.3. Follow-up monitoring and adaptive management

The iterative component of the AM process should be explicitly designed to reduce uncertainty and ensure that the direct (lethal) and indirect impacts of consented ORE projects on protected species are mitigated to acceptable levels. Follow-up monitoring gives an opportunity to test the correctness of past model predictions and ensure that best scientific knowledge is relied upon at all stages of a project development. AM provides a structured approach for 1) validating impact predictions and addressing potential non-anticipated impacts; 2) evaluating monitoring results against pre-determined thresholds of acceptable changes/impacts; 3) assessing the effectiveness of mitigation measures in ensuring that project-specific thresholds are avoided; and 4) integrate new data to refine thresholds accuracy and improve mitigation strategies accordingly.[291]

Monitoring activities should follow the 'Before-After-Control Impact' (BACI) methodology to account for changes prior to installation (baseline monitoring), during the construction and during the operational phase of a project. Indicators and early warning triggers for threshold detection in monitoring must also be rigorously defined. Here, the framework significantly relies on the monitoring guidance elaborated by Hawkins and others,[292] and Fleishman and others.[293] Hawkins *et al.*, argue that monitoring indicators should be those for which there is sufficient understanding of cause-and-effect relationships between measurable effects (i.e., collision, behavioural changes) and animal health, reproduction and survival (vital rates).[294] Careful

[291] Elizabeth R. Hawkins and others, 'Best practice framework and principles' for monitoring the effect of coastal development on marine mammals' (2017) 4 Frontiers in Marine Science, 1
[292] Ibid.
[293] Erica Fleishman and others, 'Monitoring population-level responses of marine mammals to human activities' (2016) 32 (3) Marine Mammal Science, 1004
[294] Hawkins and others, (n291), 8

consideration of the mechanisms by which the risks associated with ORE developments may have meaningful biological effects on animal reproduction and survival (vital rates) is necessary to identify key monitoring indicators. With respect to behavioural changes, the process is particularly complex in that it implies quantifying the magnitude of animals' dose-responses above which there will be meaningful biological consequences on animals' vital rates. Monitoring indicators may, for example, focus on the number of encounter/collisions or animals or short-term/long-term behavioural changes including the temporal/spatial magnitude of displacement and changes in animals' presence in relation to the development.

For each of these indicators, an 'acceptable' scale of change (e.g. magnitude of dose-responses, displacement range, collision numbers, number of exposed animals) must also be defined to inform early-warning trigger points at which adaptation/reinforcement of pre-planned mitigation actions is warranted.[295] Triggers are 'specific points where monitoring data indicates an unexpected or unfavourable trajectory' towards unwanted thresholds of acceptable changes or harm.[296]

If routine monitoring data show that the levels of changes/impacts are such that a project-specific threshold is being met or exceeded, a reinforcement of existing protective measures and/or adoption of additional corrective mitigation measures are warranted to prevent adverse impacts on conservation objectives. On the other hand, if the monitoring data indicate that risks have been overestimated in the pre-consenting phase, mitigation measures should then be reduced and progressively removed in subsequent management decisions.

[295] Ibid, 11

[296] Jan McDonald, Megan C. Styles, 'Legal Strategies for Adaptive Management under Climate Change' (2014) 26 Journal of Environmental Law, 25, 47

Robust environmental monitoring demands appropriate temporal and spatial scales for data collection.[297] Large amount of data in AM may become 'an information problem'[298] for developers and exacerbate the 'Data-Rich Information Poor' syndrome. Assessing cumulative and population-level impacts at the project-level can prove to be statistically ineffective.[299] Because of their scale, these impacts are best addressed at the strategic (SEA) level[300] in order to place project-specific impacts in the context of the objective of FCS. It is recommended that monitoring efforts at the project-level should focus on understanding and mitigating the actual interaction processes of devices/turbines with marine species and physical environment within the development site.[301] Lindeboom and Fox suggest that targeting monitoring activities on site-specific devices/receptor interaction processes will allow for available resources to be rationalised on those changes/impacts that can be effectively monitored at the project scale, thus 'turning off' the problem of DRIP.[302] Project-based monitoring programmes will also yield more useable information if using a 'question-led' approach[303] where data collection methods are designed to address specific data gaps and questions identified in the initial AA process. A 'question-led approach' requires a collaborative

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[297] Thomas A. Wilding and others, 'Turning off the DRIP ('Data-rich, information-poor') – rationalising monitoring with a focus on marine renewable energy developments and the benthos' (2017) 74 Renewable and Sustainable Energy Reviews, 848

[298] Holy Doremus, 'Adaptive Management as an Information Problem' (2010) 89 North Carolina Law Review, 1455

[299] Clive J. Fox and others, 'Challenges and opportunities in monitoring the impacts of tidal-stream energy devices on marine vertebrates' (2018) 81 Renewable and Sustainable Energy Reviews, 1926

[300] Directive 2011/42/EC of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment (Strategic Environmental Assessment Directive) [2011] OJ L.197/30. The SEA process is formalized under Article 3 of the SEA Directive as a comprehensive process of evaluating at an early stage, the environmental consequences of strategic plans and programmes adopted in the field of energy, fisheries, industry, transport and tourism. SEA may be carried out independently on a sector-basis or as part of a larger marine spatial planning process.

[301] Clive J. Fox and others, (n299), 1934; Helen Lindeboom and others, 'Offshore wind park monitoring programmes, lessons learned and recommendations for the future' (2015) 756 Hydrobiologia, 169, 174

[302] Wilding and others, (n297), 848

[303] Bennet F., Culloch R., Tait A., (2016) Guidance on effective Adaptive Management and post-consent monitoring strategies. Deliverable 5.2 & 5.4., RiCORE project, 45 pp. <http://ricore-project.eu/wp-content/uploads/2016/07/RiCORE-D5-2D5-4-Adaptive-Management-and-Post-Consent-Monitoring-Strategies-Final.pdf > (accessed 20 August 2018), at 42

approach early in the design of the EMP to identify 'prevailing uncertainty' and monitoring priorities.[304]

Further, it will be of primary importance to reflect the feedback loop of Panarchy by adopting a bottom-up approach where data gained in each development site are fed into broader marine governance processes through, for example, strategic assessments and monitoring programmes supported by government bodies. The 'double-loop learning' process that characterises the cycle of Panarchy should provide sufficient data feedbacks to inform policies and licensing decision-making in a way that reconciles further ORE deployments with the objective of FCS. The ORE industry will particularly benefit from such a 'double-loop learning' process. In theory, the SEA process should fulfil many gaps in baseline data, allowing developers to save significant time when developing detailed environmental assessments to inform permitting processes.[305] The use of AM is progressively emerging at the strategic level for OWFs. In the Netherlands, the Governmental Offshore Wind Ecological Programme (Wozep)[306] has been recently developed at the strategic level as part of an AM process for the third round of OWFs which consists of ten OWFs to be deployed in five subsequent phases of two developments. The programme aims to reduce knowledge gaps and uncertainty concerning assumptions made in the strategic assessment. Knowledge gathered by Wozep will lead to amendment of planning policies and determine the conditions under which offshore wind siting decisions can be issued in the next planning phase.[307]

[304] Courtney Schultz and Martin Nie 'Decision-making Triggers, Adaptive Management, and Natural Resources Law and Planning' (2012) 52 Natural Resources Journal, 443, 520
[305] Wright, Willsteed and O'Hagan, (n119), 155
[306] Ministry of Infrastructure and the Environment, Offshore wind energy ecological programme 2017-2021 (24 November 2016)
[307] Ibid, 8-10

7 – Conclusions and further recommendations

Adaptive management and the precautionary principle should be envisaged as important complementary 'tools' to consent and deploy ORE developments within the acceptable limits of N2000 sites' integrity. As a 'new legal paradigm for ecosystem conservation',[308] AM may be particularly useful to improve the merits of the precautionary principle in the face uncertain ecological impacts on N2000 sites. As Tickner and Kriebel point out, critical to the precautionary principle is the use of 'rigorous science'[309] to prevent irreversible harms to the integrity of N2000 sites. Critical to the achievement of rigorous science is the flexibility to integrate scientific methods and data outputs into the regulatory decision-making process. When viewed in this context, AM has an important role to play, within the precautionary principle of Article 6(3), for characterising complex environmental risk and providing early warnings of adverse impacts on N2000 sites. Follow-up monitoring provides an opportunity to correct scientific mistakes made in the licensing procedure, thus ensuring that best scientific knowledge is relied upon at all stages of a project development. The precautionary principle in turns serves as a constant 'safeguard against asymmetric information and imperfect monitoring',[310] thereby also demanding appropriate mitigation to protect the integrity of N2000 sites while waiting for more complete scientific evidence.[311]

Incorporating resilience and AM principles into the AA process would be more consistent with the underlying principle of 'ecological integrity' that Article 6(3)

[308] Tarlock, (n227), 581
[309] Joel Tickner and Daniel Kriebel, 'The role of science and precaution in environmental and public health policy' in Fisher E., Jones J., Von Schomberg R., (eds.), *Implementing the Precautionary Principle: Perspectives and Prospects* (1st edn, Edward Elgar, 2006), 43
[310] Raitanen, (n95) 97
[311] Tickner and Kriebel, (n309), 42

purports to protect. In particular, linking AM plans to pre-defined thresholds of acceptable impacts may encourage an approach to ORE permitting that is premised on the underlying science of the ecosystem approach. Nevertheless, AM does not result in 'quick wins'. It is a long process that requires a lot of forethought. Regulators need to understand the receiving environment and tailor monitoring questions to what they are trying to find out. Doremus cautions on this aspect saying: 'before deciding to employ, or to continue to employ an adaptive approach to management, and before determining the parameters of such an approach, managers should undertake an explicit, structured analysis of the need for and practicality of learning'.[312] Where uncertainty is low, some authors recommend employing a front-end approach to environmental decision-making.[313] Biber for example contends that 'rigid, inflexible standards based on front-end analysis will be more useful where dynamism and complexity are more limited and adaptive management where dynamism and complexity are more significant but still allow for learning'. [314]

AM is also an onerous process: the post-installation monitoring programme for the single SeaGen tidal energy turbine came at the considerable cost of £3 million for MCT.[315] Although scientific knowledge has been gained from monitoring, thereby allowing for the reduction of mitigation constraints, the cost of undertaking an AM approach may 'prove too much for future projects'.[316] AM should be associated with a risk-based approach to project consenting, as exemplified by the Scottish Government's SDM policy, where monitoring requirements can be customised to the risk-profile of

[312] Doremus, (n298), 1496
[313] Neil Craik, 'Implementing adaptive management in deep seabed mining: legal and institutional challenges' (2018) Marine Policy (In Press)
[314] Eric Biber, 'Adaptive Management and the Future of Environmental Law' (2013) 46 Akron Law Review, 933, 958
[315] It is worth noting that SeaGen was the first commercial-scale tidal turbine to be deployed in an area subject to high protective designations. The extensive monitoring costs has been justified by the 'pioneer character' of this project and the need to comfort regulators about its potential impacts. See further: Wright G., Willsteed E., O'Hagan A.M., (2018), Op. cit, (n119), p.148
[316] Riddoch L., (2009) 'Seal of Approval' *The Nature of Scotland*, (Winter Issue), at 22-23

each proposed development. The SDM will certainly contribute to mitigating the 'information problem' of AM by focusing post-deployment monitoring efforts on relevant receptors. However, the SDM policy follows on from a series of SEAs[317] and broader marine spatial planning process initiated by the Scottish Government.[318] Marine spatial planning (MSP) is almost systematically presented as 'an idea whose time has come'[319] to promote the sustainable use of marine resources through integrated, forward-looking and ecosystem-based organisation of human activities in the marine environment.[320] By 2021, Member States shall have adopted overarching maritime spatial plans applying an ecosystem-based approach.[321] Effective ecosystem-based MSP has a critical role to play to enhance spatial trade-offs between protection of species and habitats and ORE developments. Potentials for coexistence with protected sites may be found through the MSP process as long as ORE developments are compatible with the statutory conservation objectives of N2000 sites.[322] This Chapter has provided a model as to how this can be achieved. While MSP may facilitate trade-offs between ORE/biodiversity conservation, 'MSP does not hold intrinsic value on its own'.[323] Locating and avoiding areas of ecological importance in offshore environments is

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[317] The Scottish Government commissioned SEAs and Habitats Regulation Appraisal (strategic appropriate assessment) to examine the environmental implications of offshore wind, wave and tidal energy and developed sectoral marine plans that represent Scotland's plan option areas for commercial-scale offshore wind, wave and tidal energy developments and as such, serve as a guide for licensing/consenting decision-making. The sectoral plan for offshore wind is currently being updated: See further: Scottish Ministers, (2018) Sectoral Marine Plan for Offshore Wind Encompassing Deep-water options. <https://beta.gov.scot/publications/sectoral-marine-plan-offshore-wind-energy-encompassing-deep-water-options/> (accessed 15 October 2018)

[318] Scottish Government, (2015) Scotland's National Marine Spatial Plan. <file:///C:/Users/clelievre/Downloads/00475466.pdf> (accessed 9 April 2018); the National Plan is currently under review: Scottish Governments, (2018) National Marine Plan Review 2018. <https://beta.gov.scot/publications/national-marine-plan-review-2018-three-year-report-implementation-scotlands/> (accessed 17 October 2018)

[319] Charles Ehler, 'Marine Spatial Planning: An idea whose time has come' in Yates K.L., Bradshaw J.A., (eds.) *Offshore Energy and Marine Spatial Planning* (1st end, Routledge, 2018), 6

[320] Niko Soininen and Danial Hassan, 'Marine spatial planning as an instrument of sustainable ocean governance' in Hassan D., Kuokkanen T., Soininen N., (eds.), *Transboundary Marine Spatial Planning and International Law* (1st end, Routledge, London, 2015), 3

[321] Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014 establishing a framework for maritime spatial planning [2014] OJ L 257/135, Articles 4 and 15

[322] Ruth H. Thurstan and others, 'Compatibility of offshore energy installations with marine protected areas' in Yates K.L., Bradshaw J.A., (eds.) *Offshore Energy and Marine Spatial Planning* (Routledge, 2018), 214, 224-225

[323] Soininen and Hassan, (n320), 221

challenging due to the large dispersal range, variability in the spatial distribution, concentration and occurrence of marine species.[324] Likewise, MSP processes are constrained by technological advances and uncertainty regarding fine-scale interactions of marine wildlife and physical resources with ORE devices.[325] To be clear, AM is not a substitute for overarching planning processes. The function of the AM framework presented above, albeit project-centered, should be to deliver the evidence base which should feed back into broader overarching marine governance processes, including MSP.[326]

[324] Gartman and others, (2016a), (n281), 5

[325] Kate R. Johnson and Glen Wright, 'Marine Planning: An ocean energy perspective' in Wright G., Kerr S., Johnson K., (eds.) Ocean Energy: Governance Challenges for Wave and Tidal Stream Technologies (1st edn, Routledge, 2018), 62, 74

[326] The Scottish sectoral planning process for wave, tidal and offshore wind is iterative, and the review cycle of Scotland's sectoral marine plans is aligned with the National Marine Spatial Plan. Further description on the marine strategic planning process is given by Ian M. Davies, David Pratt, 'Strategic Sectoral Planning for Offshore Renewable Energy in Scotland' in Shields M.A, Payne A.I.L, (eds.) *Marine Renewable Energy Technologies and Environmental Interactions* (Springer, 2014), 141

CHAPTER VII

CONCLUSION

ADAPTIVE MANAGEMENT UNDER THE HABITATS DIRECTIVE – IS IT POSSIBLE?

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This Chapter summarises the findings of this thesis. It also offers a number of final legal recommendations that could assist in furthering the use of adaptive management (hereafter: AM) as a more pragmatic methodology to achieve the objectives of the Habitats Directive and reconcile the increasing contradictions between the need for offshore renewable energy and protection of marine N2000 sites. The conclusion provides an attempt to structure the implementation of adaptive management within the precautionary principle of Article 6(3) of the Habitats Directive. It intends to do so in a manner that preserves legal and regulatory certainty and moves the precautionary principle away from the unpleasant 'uncertainty paradox' of Van Asselt and Vos.[1] As stated in the introduction to this thesis, this research goes beyond merely the interests of the ORE sector and many of the recommendations are applicable to other forms of renewable energy technologies.

[1] Anne-May Van Asselt, Ellen Vos, 'The Precautionary Principle and the Uncertainty Paradox' (2006) 9(4) Journal of Risk Research, 313

1 – Introduction

Federal Agencies in the United-States have adopted adaptive management (hereafter AM) as a standard practice to address situations of environmental uncertainty in their permitting systems.[2] AM has for example, been described as a 'more integrated solution' to address complex environmental problems, such as biodiversity loss under the US Endangered Species Act.[3] In Canada, the Supreme Court of Nova Scotia has recently allowed the deployment of two tidal energy demonstration turbines operated by Cape Sharp Tidal Venture Ltd in the Bay of Fundy on the grounds that, despite the existence of gaps in baseline data, the adaptive management approach was not adopted as a 'bureaucratic convenience' but as a practical response to address these uncertainties.[4] It is now widely understood, at least in the United States, that 'unless adaptive management is given some legal definition [and legal grounding] and its application is enforceable in some way, the approach can be used as a smokescreen for open-ended and discretionary decision-making that fails to meet legal standards, lacks accountability and fails to incorporate some of the most important aspects of the paradigm including monitoring and feedback loops that inform an adaptive planning cycle'.[5] Peel also cautions that 'used indiscriminately or inappropriately adaptive management mechanisms can operate to "water down" regulatory requirements, reduce public scrutiny of development approval processes and accord preferential treatment to favoured industry, thus substantially detracting from any precautionary role they might serve in addressing uncertainty'.[6] It is therefore highly important to circumscribe the

[2] Robert Fischman, J.B. Ruhl, 'Judging adaptive management practices of US agencies' (2015) 30 Conservation Biology, 268
[3] Oliva O. Green, Ahjond S. Garmestani, 'Adaptive Management to protection Biodiversity: best available science and the Endangered Species Act (2012) 4(2) Diversity, 164, 170
[4] *Bay of Fundy Inshore Fisherman's Association v. Nova Scotia (Environment),* 2016 NSSC 286, para. 58
[5] Melinda Benson and Courtney Schultz, 'Adaptive Management and Law' in Allen C.R, Garmestani A.S. (eds.), *Adaptive Management of Socio-Ecological System* (Dordrecht: Springer 2015), 39, 41
[6] Jackeline Peel, (ed.) *The Precautionary Principle in Practice: Environmental Decision-Making and Scientific Uncertainty* (Federation Press, 2005), 154

use of adaptive management to provide sufficient certainty that the AM process will satisfy the legal protection standard of Article 6(3).

Since AM is becoming increasingly appealing to the ORE sector,[7] it will also be necessary to identify a clear legal basis under which AM strategies can be found permissible in the context of the Habitats Directive. To date, early attempts to introduce AM strategies into the AA process of the Habitats Directive have been made through the design of ‘nature inclusive’ projects.[8] Nature inclusive project designs have been advanced as a possible approach to reconcile societal/economic developments and biodiversity conservation under the Habitats Directive.[9] This approach consists in authorising projects, which despite their potential significant impacts on Natura 2000 (N2000) sites, aim to ‘neutralise’ their negative impacts by creating, restoring and or enhancing ecological values elsewhere in Natura 2000 sites.[10] Ecological enhancement/restoration measures are directly integrated into the project design. For some authors, the appeal of such more progressive approach ‘is not hard to understand’ in that it offers some flexibility to authorise developments under Article 6(3) without resorting to the derogation clause of Article 6(4).[11] However, the CJEU has been particularly reluctant to soften the precautionary standards of Article 6(3) to permit the authorisation of such ‘nature inclusive projects’. In its most recent case law, the Court has steadfastly reiterated the strict impermeability between mitigation and

[7] Sander Van Hees, ‘Large-scale water related Innovative Renewable Energy projects and the Habitats and Birds Directives: Legal issues and Solutions’ (2018) European Energy and Environmental Law Review, 15

[8] Hendrik Schoukens, (2017a), ‘Proactive Habitat Restoration and the Avoidance of Adverse Effects on Protected Areas’ (2017) 20(2) Journal of International Wildlife Law & Policy, pp.125-154

[9] Mirjam Broekmeyer, Bastmeijer, Dana Kamphorst, (2017). Towards an improved implementation of the Birds and Habitats Directive; An inventory of experiences in Austria, England, Flanders and the Netherlands in relation to two dilemmas’ (Wageningen, Wageningen Environmental Research, Report 2833). 86pp. <https://library.wur.nl/WebQuery/wurpubs/528776> (accessed 14 July 2018)

[10] Ibid, at 15; Hendrik Schoukens and Ann Cliquet, ‘Biodiversity Offsetting and restoration under the European Union Habitats Directive: balancing between no net loss and deathbed conservation’ (2016) 21(4) Ecology and Society, 572

[11] Hendrik Schoukens, (2017b) ‘Habitat Restoration Measures as Facilitators for Economic Development within the Context of the EU Habitats Directive: Balancing No Net Loss with the Preventive Approach’ (2017) 29 Journal of Environmental Law, 47, 60

compensatory measures, as respectively prescribed under Articles 6(3) and (4) of the Habitats Directive.[12]

Whilst Article 6(4) seems to feature the core aspects of proportionality and sustainable development, Chapter V has pointed out that the strict linkage between Articles 6(3) and (4) hardly provides a reliable mechanism to deliver sustainable outcomes.[13] Particularly worrying, the linear flow of Articles 6(3) and (4) may jeopardize the Habitats Directive's stated conservation objectives.[14] Improved implementation of the Habitats Directive is necessary in order to position the Directive once again as a 'gatekeeper' of biodiversity conservation while facilitating the integration of renewable energy objectives with protection of habitats and species. Some commentators have already cautioned against burdensome amendment procedures.[15] Improved implementation of the assessment requirements of Article 6(3) can be achieved without resorting to such amendments. In the Introduction to this thesis, the author stresses that the judiciary has a critical role to play in addressing the emerging 'legal disruption' posed by the ORE sector and catalysing the transition to renewable energy. Without pre-empting the finding of this Chapter, the author will thus recommend that the CJEU, in its role as the main interpreter of EU law,[16] should give more importance to the so-called 'non-regression clause'[17] of Article 6(2) when interpreting the requirements of Article 6(3) of the Habitats Directive. Where the evidence presented in the AA is scant, or uncertain, a teleological interpretation of Article 6(3) in light of Article 6(2) may

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[12] Case C-521/12 TC *Briels and Others v. Minister van Infrastructuur en Milieu* [2014] ECLI:EU:C:2014:330
[13] Chapter V, section 6.2
[14] Habitats Directive, Article 2(1) (2)
[15] Andrew Jackson, 'Renewable energy vs. Biodiversity: Policy conflict and the future of nature conservation' (2011) 21 Global Environmental Change, 1195
[16] Consolidated version of the Treaty on the European Union (TEU) [2012] OJ C 326/13, Articles 220 and 234
[17] Hendrik Schoukens, (2017c), 'Non-regression Clauses in Times of Ecological Restoration Law: Article 6(2) of the EU Habitats Directive as an unusual ally to restore Natura 2000? (2017) 13(1) Utrecht Law Review, 124

provide an avenue to achieve structured certainty by facilitating the introduction of AM principles into the appropriate assessment (AA) process.

This Chapter will first consider the legal feasibility of implementing adaptive management in light of the recent CJEU case law in *Hilde Orleans v Vlaams Gewest,*[18] *Moorburg*[19] and *Grace and Sweetman.*[20] Sections 3 and 4 will then raise the question of how AM principles can be embedded in the provisions of Article 6 of the Habitats Directive. Particular attention is paid to the requirements arising from the principle of proportionality. Finally, the author applies an innovative approach based on a short review of American case law to explore how AM principles can be more robustly incorporated into the AA process (section 5). American case law displays key attributes that one could expect from a precautionary principle based on the best scientific knowledge. The United States is probably the jurisdiction with the longest experience of AM in biodiversity law and natural resources law.[21] AM has achieved some success in judicial review under the Endangered Species Act (ESA)[22] and the Marine Mammal Protection Act (MMAP).[23] In particular, Federal Courts have come forward with a set of sophisticated legal standards that AM frameworks must satisfy to comply with the 'no jeopardy' clause of the ESA and the 'least practical adverse impact' standard of the MMPA. The EU judicature could perhaps draw some lessons from the US jurisprudence to review the design of AM processes under the AA of the Habitats Directive. The findings of this study should be strictly limited to sustainable renewable energy projects

[18] Joined Cases C-387/15 and 388/15 *Hilde Orleans and Others v. Vlaams Gewest* [2016] ECLI:EU:C: 2016:583
[19] Case C-142/16 *Commission v. Germany (Moorburg)* [2017] ECLI: EU:C: 2017:301
[20] Case C-164/17 *Grace and Sweetman v. An Bord Pleanála* [2018] ECLI:EU:C: 2018:593
[21] Jan McDonald and Megan Styles, 'Legal Strategies for Adaptive Management under Climate Change' (2014) 26 Journal of Environmental Law, 25, 31
[22] Endangered Species Act, 1973 [16 U.S.C. 1531]
[23] Marine Mammal Protection Act 2012 [16 U.S.C. 1361-1423]

in order to promote better coherence between EU goals for biodiversity conservation and renewable energy.

2 - The mitigation hierarchy of the precautionary principle: a legal impediment to the use of adaptive management in the AA process?

Hilde Orleans v Vlaams Gewest[24] is probably the first judgement to date in which the CJEU was confronted with what can be viewed as an example of AM in the context of Article 6(3).[25] This case concerned the question of whether the decision to authorise the adoption of the Regional Development Implementation Plan (RDIP) for the port of Antwerp (Belgium), in light of a proactive nature restoration programme contained in the plan, was compatible with the mitigation hierarchy of Article 6 of the Habitats Directive, as enshrined by the CJEU in *Briels and Others*.[26] The RDIP provided for the creation and replacement of several isolated patches of natural habitats in core ecological areas in order to neutralise the adverse effects of port development activities on a N2000 site.[27] The creation of natural habitats had to be 'imperatively' put in place before the occurrence of any possible adverse effects on the habitats of the SAC. Plus, the RDIP incorporated explicit requirements for monitoring and adaptation to ascertain the true impact of the port development and prevent any ecological regression.[28] The development of the areas would proceed only after the establishment of core ecological areas could be demonstrated to be sustainable. The CJEU first noted that adverse effects on the integrity of the site were certain since the RDIP will result in the disappearance

[24] Joined Cases C-387/15 and 388/15 *Hilde Orleans and Others v. Vlaams Gewest* [2016] ECLI:EU:C: 2016:583
[25] Hendrik Schoukens (2017a), (n8), 137
[26] Case C-521/12 TC *Briels and Others v. Minister van Infrastructuur en Milieu* [2014] ECLI:EU:C: 2014:330
[27] See further for factual details: Schoukens, (2017a), (n8), 135
[28] *Hilde Orleans and Others*, paras. 20, 27

of an area of 20 hectares of habitats in the SAC in question.[29] The CJEU then found that, at the time of the AA, the future prospects that proactive habitat creation measures will be effective in mitigating the adverse effects of the plan the site were difficult to forecast with any degree of certainty. The Court reasoned that the measures in question have not yet been completed and as such, their possible outcomes will be visible only several years after their implementation.[30] The CJEU concluded that future creation of sustainable habitats, the completion of which will take place before the occurrence of adverse effects on a natural habitat type but after the conduct of the AA, must be regarded as 'compensatory' by nature and hence, cannot be taken into account in the AA process.[31] By principally excluding proactive nature restoration measures from the scope of Article 6 (3), the CJEU effectively implements the mitigation hierarchy of the precautionary principle[32] which lies at the heart of *Briels*. Since the seminal *Briels* case, it is settled case law that the application of the precautionary principle under Article 6(3) requires competent national authorities to take into account 'protective measures, which forming part of the project, aim at avoiding or reducing any direct adverse effects on the site in order to ensure that it does not adversely affect the integrity of the site'.[33] Measures aiming at 'compensating for the negative effects of the project on a Natura 2000 site' can only be considered as a last resort, if after a negative AA, the proposed development satisfies the conditions of Article 6(4).[34]

It is still unclear whether the CJEU would reach the same reasoning if the measures envisaged by the Flemish Authorities in *Hilde Orleans* could be characterised as mitigation measures by nature. The Court has shed some light on this question in

[29] Ibid, para.37
[30] Ibid, paras.52, 56
[31] Ibid, paras.52, 64
[32] See further: Schoukens and Cliquet, 'Mitigation and Compensation under EU Nature Conservation Law in the Flemish Region: Beyond the Deadlock for Development Projects' (2014) 10 (2) Utrecht Law Review, 114
[33] *Briels and others*, (n26), para.28
[34] Ibid. para.29

Moorburg.[35] This case similarly arose from infringement proceedings brought by the EC against Germany for having wrongly classified some measures as 'mitigation' under Article 6(3).[36] Briefly, the German authorities authorised the construction of a coal-fired power plant on the grounds that the plant was not incompatible with the conservation objectives of a group of N2000 sites located downstream in view of the installation of a fish ladder, the objective of which, was to increase migratory fish stocks by allowing fish to reach their breeding areas more quickly. This system was expected to compensate for the death of Annex II fish during the cooling operations of the plant which drew large quantities of water in from the river. A multi-phase monitoring programme was prescribed to verify the effectiveness of that measure. The CJEU first reiterated its previous case law whereby competent national authorities can only authorise an activity if, at the time the authorisation, no reasonable scientific doubt remains as to the absence of adverse effect on the integrity of the site.[37] In that regard, the Court noted that the 'impact assessment itself did not contain definitive data regarding the effectiveness of the fish ladder and merely stated that its effectiveness could only be confirmed following several years of monitoring'.[38] With this in mind, the fish ladder, together with the multi-phase monitoring programme, were not sufficient to satisfy the requirements of Article 6(3) insofar as, at the time of decision-making, these measures could not guarantee beyond all reasonable doubt, that that plant would not adversely affect the integrity of the site.[39]

The CJEU did not clearly specify whether the consideration of the fish ladder system as a mitigation measure was compatible with *Briels*.[40] Regardless of this semantic

[35] Case C-142/16 *Commission v. Germany* (*Moorburg)* [2017] ECLI: EU:C: 2017:301
[36] Ibid, paras.9, 17
[37] Ibid, paras.33, 42
[38] Ibid, para.38
[39] *Moorburg,* (n35), paras. 38, 43
[40] Interestingly enough, at paragraph 38 of the *Moorburg* judgement, the CJEU recognised that the 'fish ladder was intended to reduce direct significant effects on the Natura 2000 area. This suggests that the fish ladder may have been envisaged as a mitigation action by the Court.

distinction, the findings in *Moorburg* are instructive for the remainder of this analysis: competent national authorities are not entitled to apply any element of adaptive management in their consenting procedures unless they can establish, beyond all reasonable scientific doubt, that the mitigation/compensatory measures envisaged will be effective in preventing adverse impact on the integrity of N2000 sites.[41] Whilst it may be true that, in the German case, the design of the monitoring system was methodologically flawed,[42] this ruling presents a pernicious impediment to the use of adaptive management strategies under the AA of the Habitats Directive.[43] The systematic judicial requirement for front-loaded certainty leaves very little room for AM strategies within the scope of Article 6(3). Where certainty cannot be ascertained beyond all reasonable scientific doubt during the AA stage, the only way to proceed is through the derogation clause of Article 6(4).

There is certain logic behind the CJEU reassertion of the strict impermeability between mitigation and compensatory measures, as enshrined in *Briels*. As discussed in Chapter V, the complexity of ecological systems makes the success of restoration actions relatively weak and sometimes, inefficient to resolve trade-offs between economic development and conservation.[44] Second, the decision in the *Moorburg* case is centred on a coal-fired power plant. A less demanding mitigation strategy under Article 6(3) may open a Pandora's Box of more flexibility when permitting unsustainable developments. An increasing reliance on compensation/restoration in the context of the

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[41] Stefan Möckel, 'The assessment of significant effects on the integrity of "Natura 2000" sites under Article 6(2) and Article 6(3) of the Habitats Directive' (2017) 23 Nature Conservation, 57, 77

[42] At paragraph 44 of the *Moorburg* judgement, the Court explains that 'the results of that monitoring may be irrelevant if the data are collected at times when the Moorburg plant was not using the continuous cooling mechanism. Secondly, the monitoring measures only the number of fish that manage to bypass the plant via the fish ladder. Accordingly, that monitoring is not capable of ensuring that the fish ladder will avoid any adverse effects on the integrity the protected sites'.

[43] Hendrik Schoukens, (2017d). 'Adaptive Management in the Context of the Habitats Directive: The Dutch Programmatic Approach to Nitrogen as ultimate test-case?' (Annual EELF Conference 2017, Copenhagen, Sustainable management of natural resources –legal approaches and instruments)

[44] David Moreno-Mateos and others, 'The true Loss Caused by Biodiversity Offset' (2015) 192 Biological Conservation, 552, 557

AA would undermine efforts to avoid and mitigate the true impacts of a project. As observed by Schoukens and Cliquet, since the derogation clause of Article 6(4) is only accessible to projects of overriding public interest, it is likely that maintaining a strict preventive approach under Article 6(3) will lead to more permit refusals for unsustainable plans or projects.[45]

Perhaps more shockingly, the Court has very recently upheld the same ruling in a case concerning the legality of a staggered Species and Habitats Management Plan (SHMP) elaborated with a view to reconciling the approval of a wind energy development with the conservation objectives adopted for the hen harrier, a protected species of bird. *Grace and Sweetman*[46] arose from a request for preliminary ruling on the interpretation of Article 6(3) by the Irish Supreme Court. As regards the factual background, An Bord Pleanála, the statutory planning authority in Ireland, had granted permission for a wind farm development of 16 turbines within a SPA designated for the hen harrier. The SHMP provided for a series of measures including the restoration of blanket bogs and wet heath as well as the provision of new areas of optimum habitat for the hen harrier and other wildlife (by felling and replacing the canopy forest).[47] These measures, some of them commencing a year prior construction, were designed to ensure that the proportion of suitable habitats would not be reduced and might indeed be enhanced throughout the lifetime of the wind farm.[48] The measures envisaged to address the adverse impacts of the wind farm were an integral part of the project, albeit their implementation would take place outside the wind farm area in other locations of the SPA. In essence, the CJEU held that the case was similar to *Briels* and *Hilde Orleans* in that it was based on the assumption that the proposed habitat creation and restoration

[45] See further: Hendrik Schoukens and Ann Cliquet, 'Biodiversity Offsetting and restoration under the European Union Habitats Directive: balancing between no net loss and deathbed conservation' (2016) 21(4) Ecology and Society, 572
[46] Case C-164/17 *Grace and Sweetman v. An Bord Pleanála* [2018] ECLI:EU:C: 2018:593
[47] *Grace and Sweetman*, para.44; Opinion AG Tanchev, 19 April 2018, para. 24
[48] Ibid, para.22

measures would address the potential adverse effects of the wind farm.[49] Therefore, the Court rejected the measures envisaged by the SHMP and considered that these measures were compensatory in nature and, hence, should be considered under Article 6(4).[50] Perhaps, the Court added a minor refinement when clarifying:

> ‘It is only when it is sufficiently certain that a measure will make an effective contribution to avoiding harm, guaranteeing beyond all reasonable doubt that the project will not adversely affect the integrity of the area, that such a measure may be taken into account in the appropriate assessment of Article 6(3)’.[51]

Here again, the decision is firmly entrenched in the precautionary principle.[52] Based on the precautionary principle, the AA shall not leave any reasonable scientific doubt as to the absence of adverse effect of the proposed works on the integrity of the site concerned. As a matter of principle, the only solution left in order to authorise renewable energy projects for which reasonable scientific doubt remains, despite the adoption of mitigation measures, is by means of the derogation clause of Article 6(4).[53]

It is worth noting that the case law to date seems to exclude from the scope of Article 6(3) AM strategies that have been adopted as part of ‘nature inclusive projects’.[54] As discussed in the introduction to this Chapter, an integrated approach to nature conservation consists of developing ‘nature inclusive projects’ which, despite their adverse effects on N2000 values, address these negative effects by creating and or restoring ecological values elsewhere in the N2000 areas concerned.[55] The design of

[49] *Grace and Sweetman,* para. 49
[50] Ibid, para.57
[51] Ibid, para.51
[52] In para.54, the Court states as follows: the foregoing considerations are confirmed by the fact that Article 6(3) integrates the precautionary principle and makes it possible to prevent in an effective manner adverse effects on the integrity of protected areas’.
[53] Schoukens and Cliquet, (n32), 198
[54] Schoukens, (2017a), (n8); Hendrik Schoukens, (2017b), (n11)
[55] Broekmeyer, Bastmeijer and Kamphorst, (n9), 15

nature inclusive projects seem to offer some leverage to approve developments with harmful effect on the integrity of protected sites under Article 6(3).[56] Notwithstanding this, the message of the Court is clear: biodiversity restoration/creation measures, even if functionally linked to project developments, cannot be considered as mitigation measures for the purpose of the appropriate assessment of Article 6(3). Restoration measures can only be relied upon as a last resort option under the derogation clause of Article 6(4). Commentators are beginning to deplore the consequences of these rulings for the legal feasibility of AM strategies under Article 6(3). Schoukens, for example, contends that 'an adaptive management approach to Article 6(3) could open the door to a more pragmatic and reconciliatory approach to nature conservation, one that would move more appreciably beyond the "deathbed" conservation' approach.[57] In light of the cited case law, it is quite obvious that the issue in the main proceeding mainly pertained to the nature of the measures envisaged by Member States to support an AA and not the use of AM strategies *per se*. Therefore, an important question arises from the foregoing: Is there not another way to make adaptive management legally permissible under the mitigation scheme of Article 6(3)?

[56] Schoukens, (2017b), (n11), 57; See also: Schoukens and Cliquet, (n45), 575
[57] Schoukens (2017a), (n8), 140

3 - The non-regression clause of Article 6(2): a reactive approach to adaptive management under the appropriate assessment process?

Little attention has been given to the non-regression clause of Article 6(2). Article 6(2) establishes a general obligation[58] to take 'appropriate steps' to avoid deterioration of natural habitats and disturbance of species which could have significant effects in light of the objectives of the Habitats Directive.[59] Article 6(2) constitutes an important 'fall-back clause' against all harmful projects and activities that fall outside the scope of the AA of Article 6(3).[60] The CJEU has steadfastly interpreted this provision as a general obligation of protection[61] which, among other things, imposes a duty to review the implications of consented projects where their implementation results in further deterioration of natural habitats or disturbances to species protected by N2000 sites.[62] It is settled case law that existing projects that do not satisfy the requirements of Article 6(3), by way of being authorised before the inclusion of a site on the SCIs list or before the entry into force of the Directive, may be subject to subsequent review under the scope of Article 6(2).[63] The precautionary principle applies for this purpose: where 'a probability or risk' of deterioration or disturbance exists, the general obligation of protection of Article 6(2) requires that such review be carried out as an appropriate step without a cause and effect relationship between that activity and significant disturbance to the species having to be proved'.[64] In the recent *Grüne Kaga Sachsen* judgement,[65]

[58] Case C-258/11 *Sweetman and Others v. An Bord Pleanála* [2013] ECLI:EU:C: 2013:220, para.33; Case C-404/09 *Commission v. Spain* [2011] ECR I-11853, para.125; Case C-6/04 *Commission v. United Kingdom*, Op. cit, paras.57, 58
[59] Habitats Directive, Article 6(2)
[60] Schoukens, (2017c), (n17), 133
[61] Case C-399/14 *Grüne Kaga Sachsen eV and Others v. Freistaat Sachsen* [2016] ECLI: EU:C: 2016:10, para.37; Case C-226/08 *Stadt Papenburg v. Bundesrepublik Deutschland* [2010] ECR I-131, paras.49; *Sweetman*, Op. cit, para.33
[62] Hendrik Schoukens, 'Ongoing activities and Natura 2000 sites' (2014) 11 (1) Journal of European Environmental & Planning Law, 1
[63] C-404/09 *Commission v. Spain*, (n58), para. 125; Case C-6/04 *Commission v. United Kingdom* [2005] ECR I-9056, paras. 57-58; *Stadt Papenburg*, (n61), paras.48-49
[64] *Commission v. Spain*, (n58), para. 142; *Grüne Kaga Sachsen eV and Others*, (n61), paras.42-44

the CJEU confirmed this ruling and specifically relied on Article 6(2) to require review of the authorisation of a road bridge project on the river Elbe. The project was approved before the inclusion of the Elbe valley in the list of SCIs and following an assessment procedure that did not meet the requirements of Article 6(3).[66] In this case, because there had been no AA prior to authorisation, the CJEU held that Article 6(2) entails an obligation to review the implications of the project for the site, as an appropriate step, in order to avoid deterioration or disturbance.[67] Such a review must enable the competent authority to guarantee that the implementation of this project will not cause deterioration or disturbance which could be significant in relation to the objective of the Habitats Directive.[68]

One may ponder whether Article 6(2) could not also be understood as an obligation to review permitting conditions of ongoing ORE projects which, albeit having been lawfully authorised pursuant to an Article 6(3) AA, may subsequently give rise to deterioration/disturbance of habitats or species? The CJEU may have come to such conclusion in its seminal *Waddenzee* case.[69] In essence, the *Waddenzee* judgement concerned the question of whether mechanical cockle fishing, which had been carried out for many years and for which a licence was granted annually, amounted to a plan or project within the meaning of Article 6(3) and as such, required the conduct of a fresh AA process. The CJEU made it clear that Articles 6(2) and (3) serve distinct purposes and as such, they cannot be applied concomitantly in the AA process.[70] Compliance with Article 6(3) in the AA process entails a presumption of 'no deterioration or

[65] *Grüne Kaga Sachsen eV and Others,* (n61), paras.44-46
[66] Ibid, para.46
[67] Ibid. paras.44, 46
[68] Ibid, para. 53
[69] Case C-127/02 *Waddenzee* [2004] ECR I-07405
[70] At paragraphs 34 and 38 of the Waddenzee judgement, the Court held that Article 6(3) contains specific procedural obligations to assess, by means of a preliminary appropriate assessment the effects of new activities on the integrity of Natura 2000 sites. By contrast, Article 6(2) establishes an obligation of general protection consisting in avoiding deterioration and disturbances which could have significant effects in the light of the Directive's objectives, and cannot be applied concomitantly with Article 6(3).

disturbance' which excludes the concomitant application of Article 6(2) in the initial AA process.[71] In *Waddenzee*, the Court has nevertheless reasoned that an authorisation granted pursuant to the AA of Article 6(3) does not preclude that a consented project will subsequently give rise to deterioration or disturbance, 'even where the competent national authorities cannot be held responsible for any error'.[72] In this situation, the application of Article 6(2) 'makes it possible to satisfy the essential objective of the preservation and protection of the quality of the environment, including the conservation of natural habitats and of wild fauna and flora, as stated in the first recital in the preamble to that Directive'.[73] In other words, the presumption of no-deterioration and no-disturbance underpinning the relationship Articles 6(2) and (3) no longer applies. Without elaborating further on the question of whether a new AA was necessary for each new licence issued, this ruling suggests that 'additional measures'[74] may be sought in the post-project approval phase under Article 6(2) to prevent future deterioration of natural habitats or disturbance of species.

In a similar vein, in *Grüne Kaga Sachsen*,[75] AG Sharpston has also remarkably stressed that even where an approval has been granted in compliance with Articles 6(3) and (4), Article 6(2) lays down an ongoing obligation to carry out 'constant monitoring' and to 'take appropriate steps' to avoid deterioration and disturbance.[76] 'That must be true a fortiori where the procedure was not fully compliant and needs to be rectified'.[77] In particular, where there is a change in the conditions of a N2000 site or in the details of the project, an appropriate step under Article 6(2) may entail 'the need for review in light of the changed situation to avoid deterioration of habitats or disturbances of

[71] *Waddenzee*, paras.36
[72] Ibid, para.37
[73] Ibid
[74] Schoukens, (2017c), n17), 136
[75] Case C-399/14 *Grüne Kaga Sachsen eV and Others*, Opinion of AG Sharpston, 24 September 2015
[76] Ibid, para.65
[77] Ibid.

species'.[78] This should also be the case where 'the original assessment has not clearly identified what impact the project would be likely to have on habitats and species in the site, leaving the possible existence of a threat undetermined'.[79] In this situation, AG Sharpston explains that 'a review of the original assessment seems likely to be an appropriate step to take, though alternatives should be envisaged', through for example 'suitable but circumscribed preventive measures'.[80] Since Article 6(2) imposes an ongoing obligation to ensure the same level of protection as Article 6(3), it would indeed, run counter to the objectives of the Directive to allow planning approvals to stand unchanged after a significant change in the circumstances of the site or details of te project.[81] Although not legally binding, AGs' opinions are still authoritative. Such an interpretation of Article 6(2) is an important refinement in that it clearly accounts for uncertainty and could pave the way towards a more adaptive approach to appropriate assessment with a view to preventing deterioration or disturbance that may materialise as a result of the absence or imprecision of data relied upon in the initial AA process.

Domestic Courts may have begun to endorse a similar understanding of Article 6(2). In a recent judicial review (*Murphy's Application for Judicial Review*),[82] the Court of Appeal of Northern Ireland reiterated the CJEU ruling in *Grüne Kaga Sachsen* by ruling that in cases where there has been no AA prior to authorisation, Article 6(2) requires the carrying out of an assessment that meets the requirements of Article 6(3). In this case however, eight years passed between the initial AA and the authorisation of road development works. Whilst Article 6(2) does not necessarily require the conduct of a new AA, the Court of Appeal held that a high standard of investigation nonetheless arises from the provisions of Article 6(2), even though there is no prescribed form for

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[78] Ibid, paras.43 and 71 (1)
[79] Ibid, Opinion of AG Sharpston, para.49
[80] Ibid.
[81] Ibid.
[82] *Murphy's Application for Judicial Review v. Minister for Infrastructures* [2016] NICA 51

the conduct of such an investigation.[83] On this ground, the Court remarkably ruled that a subsequent ‘statement’ which aimed to review the findings of the initial AA process and establish the risk of disturbance or deterioration in light of new circumstances was an ‘appropriate investigation’ which complied with Article 6(2).[84]

Unfortunately, the CJEU did not have the opportunity to endorse the AG Sharpston’s position as the construction of the road bridge in the *Grüne Kaga Sachsen* case was approved before the inclusion of the site in the list of SCIs and thus, the project was not subject to the requirements of Article 6(3). The CJEU has however characteristically employed a teleological interpretation of the provisions of the Habitats Directive, agreeing that Article 6(2) and (3) must ‘be construed as a ‘coherent whole’ in light of the conservation objectives pursued by the Directive.[85] In line with this method of interpretation, the CJEU and domestic courts should give more importance to requirements to ‘take appropriate steps’ under Article 6(2) to enhance the outcomes of the AA of Article 6(3) in the face of uncertain ecological impacts. Unlike the EIA Directive,[86] the Habitats Directive is depicted as a procedural hurdle[87] with no explicit requirement to implement follow-up monitoring and to adapt decision-making to new monitoring data. Although Article 6(2) cannot be applied concomitantly during the initial AA,[88] nothing in the CJEU jurisprudence seems to rule out the application of Article 6(2) post-consent, where a risk of deterioration or disturbance cannot be excluded. The procedure prescribed by Article 6(3) only applies ‘before the Member

[83] Ibid, para.31
[84] Ibid, para.35
[85] *Sweetman and Others,* (n58), para.32; *Grüne Kaga Sachsen eV and others,* (n61), para.52
[86] Article 8(a) (4) of the revised EIA Directive (Directive 2014/52/EU) makes post-consenting monitoring a mandatory requirement, obliging Member States to determine the procedures for monitoring the ‘significant adverse effect on the environment.
[87] Geoffrey Wandesforde-Smith and Nicholas Watts, ‘Wildlife Conservation and Protected Areas: Politics, Procedure, and the Performance of Failure Under the EU Birds and Habitats Directive’ (2014) 17 Journal of International Wildlife Law and Policy, 62, 65
[88] *Waddenzee,* (n69), para.36

States create planning rights whose exercise could adversely affect a site'.[89] The scope of Article 6(2) on the other hand, is broader in that it constitutes an ongoing obligation to take appropriate actions in order to avoid deterioration and disturbance.[90] As a general obligation of protection, the requirement 'to take appropriate steps' under Article 6(2) could be operated more effectively, in a teleological way, to require continuous environmental monitoring and re-evaluation of permitting conditions regardless of whether a licence was granted in compliance with Article 6(3). Increased monitoring and corrective mitigation activities must be envisaged as 'appropriate steps' where the monitoring outcomes confirm that the operation or functioning of a consented ORE project is likely to give rise to disturbance or deterioration such that this may exceed precautionary thresholds of acceptable change/harm.

In this respect, the CJEU has steadily repeated that an activity complies with Article 6(2) only if it is guaranteed that it will not cause any disturbance likely to significantly affect the objectives of the Directive, particularly its conservation objectives.[91] Since Article 6(2) aims to ensure the same level of protection as Article 6(3), 'appropriate steps' may then be taken accordingly, on the basis of Article 6(2), to guarantee that the implications of operating ORE projects in or near N2000 sites remains compatible with site conservation objectives at all stages of their development. This interpretation would accord with the reasoning adopted by AG Kokott in *Commission v. France*.[92] AG Kokott argued that 'deterioration' or 'disturbance' within the meaning of Article 6(2) must 'be assumed to exist if the conservation objectives of the relevant N2000 area are

[89] Case C-6/04 *Commission v. United Kingdom* [2005] ECR I-9056, Opinion AG Kokott, paras.53, 55
[90] European Commission, 'Managing Natura 2000 sites. The provisions of Article 6 of the Habitats Directive' (Commission notice) C (2018) 7621 final, p.24; Case C-127/02 *Waddenzee*, (n69), paras.37-38
[91] Case C-241/08 *Commission v. France* [2010] ECR I-01697, para.32, Case C-399/14 *Grüne Kaga Sachsen eV and other*, (n61), para.41; *Commission v. Spain*, (n58), para.126
[92] Case C-241/08 *Commission v. France* [2010] ECR I-01697

affected'.[93] In a similar line of thought, AG Sharpston's opinion on the *Sweetman* case also made it clear that compliance with Article 6(2) 'is to be measured having regard to the conservation objectives of the site'.[94] The requirement of Article 6(2) consists in taking 'all appropriate steps to avoid those sites' conservation objectives to be prejudiced'.[95] The conservation objectives of the site are therefore of importance not only in the identification of disturbance of species or deterioration of habitats,[96] but also in the assessment of significance.[97] After all, the absence of adverse effects on the integrity of the site necessarily assumes that no deterioration or significant disturbance is likely to arise within the meaning of Article 6(2).[98]

With regard to the nature of the corrective measures envisaged under Article 6(2), the CJEU emphasises that Article 6(2) imposes a duty to take, 'in good time', the necessary measures to bring deterioration or disturbances to an end as quickly as possible.[99] These measures shall not be reactive but anticipatory by nature in order to bring threats of deterioration or disturbance to an end before such deterioration or disturbance has occurred.[100] The precautionary principle applies for this purpose: since Article 6(2) and Article 6(3) are designed to ensure the same level of protection, the mere existence of a 'probability or risk' of disturbance for a qualifying species constitutes an infringement of Article 6(2).[101] Similar to the requirements of AA, the threshold at which subsequent review is warranted is a very light one. Such concretisation of the precautionary

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93 Case C-241/08 *Commission v France*, Opinion of AG Kokott, 25 June 2009, para.28
94 *Sweetman,* Opinion of AG Sharpston, 22 November 2012, para.44
95 Ibid.
96 European Commission, (n90), 30
97 Möckel, (n41), 81
98 *Waddenzee*, (n69), para.36
99 Case C-404/09 *Commission v. Spain,* (n58), para.152
100 Case C- 418/04 *Commission v. Ireland* [2007] ECR I-11067, paras.208, 209
101 *Commission v. Spain*, (n58), para.142; *Grüne Kaga Sachsen eV and Others,* (n61), para.42; Möckel, (n41), 79

principle[102] raises the important issue of legal certainty for developers who have placed legitimate expectation in their licences.[103] No reason based on the principle of legal certainty or the principle of the protection of legitimate expectation precludes a realised development from being subject to subsequent review applying the requirements of Article 6(2).[104] According to the Court, the effective protection of N2000 sites would otherwise be jeopardised.[105] Developers must accept that the operation of their developments might be altered by subsequent review of their licence conditions. In practice however, once a project with negative impacts is granted a licence, it may be difficult to alter its operating conditions or even, to terminate the licence if it turns to be harmful in future.[106] The risk that is introduced for developers by such interpretation must be carefully accounted for.

In addition, Article 6(2) is now increasingly understood in the legal literature as a result-based obligation for Member States.[107] As such, the 'non-regression clause' of Article 6(2) cannot be satisfied by a mere duty to act with due diligence but by the achievement of the result of no-deterioration/no-disturbance of natural habitat types and species. The landmark decision of the CJEU in *Commission v Ireland* provides a good illustration in this respect. The CJEU held that in order to fulfil its obligations under Article 6(2), it was not only necessary for the Irish Government to take measures to stabilise the problem of overgrazing in order to avoid deterioration of the priority habitat type of the

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[102] Emma Lees, 'Concretising the precautionary principle in Habitat protection - *Grüne Lige Sachsen v Freistaat Sachsen and Orleans v. Vlaams Gewest* (2017) 19(2) Environmental Law Review, 126
[103] *Grüne Kaga Sachsen eV and others,* Opinion of AG Sharpston, (n75), para.65
[104] Case C-226/08 *Stadt Papenburg,* Op. cit, (n61), paras.42-44
[105] Ibid.
[106] Van Hees, (2018), (n7), 31
[107] Ann Cliquet, Kris Decleer, Hendrik Schoukens, 'Restoring nature in the EU: The only is up?' in Born C.H, Cliquet A, Schoukens H, Misonne D, Van Hoorick G, (eds.), *The Habitats Directive in its Environmental Law Context: European Nature's Best Hope?* (Routledge, 2015), 265, 276; Hendrik Schoukens, 'Atmospheric Nitrogen Deposition and the Habitats Directive: Tinkering with the Law in the Face of the Precautionary Principle' (2015) 2 Nordic Environmental Law Journal, 25, 31; Arie Trouwborst, 'The EU Habitats Directive and wolf conservation and management on the Iberian Peninsula: a legal perspective' (2014) 26 Galemys: Spanish Journal of Mammalogy, 1, 11

Red Grouse, but also to ensure that damaged habitat was allowed to recover.[108] As a result-based obligation, Article 6(2) may address some commentators' concerns whereby AM may lead to a 'fait accompli-scenario';[109] a situation where licensing authorities may be inclined to use AM as a smokescreen covering up 'loopholes and gaps in ecological surveys' to permit harmful projects.[110]

In summary, while an absolute procedural obligation to review permitting conditions cannot be inferred from Article 6(2),[111] a teleological interpretation of Article 6(3) in light of Article 6(2) would still provide an elegant way to initiate a paradigm shift towards more adaptive AA processes, as recommended in section 3 of Chapter VI. Through the implementation of robust monitoring linked to the possibility of routine review of permitting conditions, a stronger linkage between Articles 6(2) and (3) will provide regulatory decision-makers with an opportunity of control and better scientific knowledge necessary to consent and manage ORE deployments within the limits of the integrity of N2000 sites. Such a re-interpretation would also give developers the opportunity to deploy, monitor and learn about their technologies while ensuring that their deployment does not cause irreversible damage to N2000 qualifying features. If an ongoing obligation to monitor and to review the implications of consented developments under Article 6(3) can be teleologically derived from Article 6(2), the Habitats Directive may already provide a 'ready-made' legal basis to consent future ORE developments under AM protocols.

[108] Case C-117/00, *Commission v. Ireland* [2002] ECR I-05335, para.31
[109] Schoukens and Cliquet, (n32) 207; See further: Ralph Frins and Hendrik Schoukens, 'Balancing wind energy and nature protection: From policy conflicts toward genuine sustainable development?' In Squintani L., Vedder H.H.B. (ed.), *Sustainable energy united in diversity. Challenges and approaches in energy transition in the European Union* (EELF, 2014), 85, 105
[110] Ibid
[111]At paragraph 40 of *Grüne Kaga Sachsen eV and others,* the CJEU made it clear that the term 'appropriate steps' implies that Member States enjoy discretion when applying that provision.

This reasoning reaches its limits when confronted with the maxim *'Lex specialis derogat legi generali'*. As general protection rule, Article 6(2) is superseded by the *lex specialis* provisions of Article 6(3). As such, the 'non-regression principle' of Article 6(2) may offer little room to revisit permitting conditions that have been issued in compliance with Article 6(3). As Schoukens rightly writes:

> 'Article 6(2) [does] not only cover ongoing degradation, but in some ways situations which involve additional future losses, especially if such activities appear to have been based on flawed or incomplete assessments. Among other things, Article 6(2) forces competent authorities to rectify earlier mistakes that have occurred in earlier permitting procedures, or, in other instances, to adjust permitting conditions in view of recently changed environmental conditions'.[112]

Article 6(2) seems to suggest a reactive approach to AM, after a project has been approved. The Court has never held that Article 6(2) cannot be applied concomitantly with the derogation clause of Article 6(4). Hence, it would be possible to permit ORE developments under proactive AM within the derogation scheme of Article 6(4). This question goes beyond the scope of this study. As stated above, the provisions of Article 6 of the Habitats Directive must 'be construed as a 'coherent whole' in light of the objective of the Directive.[113] From there, if Article 6(2) cannot be used in conjunction with Article 6(3) to require continuous monitoring and routine review of consented projects, neither can it be applied within the scope of Article 6(4). If a teleological interpretation of Article 6(3) in light of Article 6(2) offers little promise to facilitate the introduction of AM principles into the AA process, an obligation of continuous

[112] Hendrik Schoukens, (2017c), (n17), 136
[113] *Grüne Kaga Sachsen eV and others*, (n61), para.52

monitoring and re-evaluation certainly arises from the general principle of proportionality.

4 - Adaptive management in light of the proportionality principle

The proportionality principle serves as an important 'limiting factor to the precautionary principle'.[114] As stated many times throughout this thesis, the proportionality principle requires that measures adopted on the basis of precaution do not exceed the limits of what is appropriate and necessary to attain the objectives legitimately pursued.[115] A truly proportionate precautionary approach involves opting for the less restrictive alternative while still attaining the legitimate objective pursued. Leading author Marr rightly explains that the doctrine of proportionality necessarily implies that the precautionary principle should no longer apply 'when its requirements ceased to exist'.[116] This is the case for example when new scientific evidence has been produced, reducing scientific uncertainty to such an extent that the risk becomes merely hypothetical. Acting on hypothetical risks would be contrary to the principle of proportionality.[117] Gillespie notably explains that the core of the precautionary principle involves a second step, which is an attempt to resolve uncertainty. For this reason, he argues that 'any measures adopted under the auspice of the precautionary principle are of a transitory nature and may be eclipsed when greater scientific evidence is ascertainable'.[118] Trouwborst also writes that the proportionality principle is a 'crucial feature of the application of the precautionary principle in the sense that precautionary responses to environmental threats ought to correspond to the perceived dimensions of

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[114] Simon Marr, 'The Limitations of the Precautionary Principle' in Marr S., *The Precautionary Principle in the Law of the Sea: modern decision-making in International Law* (Kluwer Law International, 2003), 35

[115] Case C-331/88 *Fedesa and Others* [1990] ECR I-4023, para. 13; Case C-157/96 *National Farmers' Union and Others* [1998] ECR I-2211, para.60; Case C-343/09 A*fton Chemical* [2010] ECR I-07027, para.45

[116] Marr, (n114), 37

[117] Case T-392/02 *Solvay Pharmaceuticals BV* [2003] ECR II-4555, para.130

[118] Alexander Gillespie, *Conservation, Biodiversity and International Law* (Edward Elgar, 2013), 466

the risk involved'.[119] As scientific evidence accumulates, the intensity of precautionary measures should also be 'proportionally responsive'[120] to the gravity and probability of the threat. In this respect, Marr convincingly asserts that the proportionality principle entails 'a duty to monitor the premises upon which the precautionary principle is applied'.[121] Established case law in the field of human health protection seems to confirm this point when standing for the proposition that even the most stringent precautionary measures would still be proportionate as long as the measures are provisional pending the availability of additional scientific evidence.[122] The withdrawal of authorisation for the virginiamycin was not deemed disproportionate by the CFI because it constituted a provisional measure subject to a duty of re-examination.[123] In a more recent decision, the CJEU also held that 'the Community legislature is entitled to adopt provisional risk management measures necessary to ensure a high level of health protection and may do so whilst awaiting further scientific information for a more comprehensive risk assessment'.[124] Even before the formal integration of the precautionary principle within the EU legal order,[125] the duty of review was already implicitly endorsed in embryonic case law on the application of the principle.[126] The duty to re-examine precautionary measures was even more strongly formulated in *Agrarproduktion Staebelow GmbH* where the CJEU held that 'when new elements change the perceptions of a risk or show that risk can be contained by less restrictive measures than the existing measures, it is for the institutions and in particular the

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[119] Arie Trouwborst, *Precautionary Rights and Duties of States* (Martinus Nijhoff Publishers, 2006), 149
[120] Ibid, at 150
[121] Marr, (2003), (n114), 37
[122] Case C- 343/09 A*fton Chemical* [2010] ECR I-07027, para.53; Case T-13/99 *Pfizer Animal Health SA* [2002] ECR II-03305, paras.387, 444
[123] Ibid.
[124] Case C-154/04 and C-155/05 *Alliance for Natural Health* [2005] ECR I-06451, para.69
[125] The precautionary principle was formally introduced by the Treaty of Maastricht within the Environmental Title as a guiding principle of the environmental policy (former Article 130r (2) of the Treaty on European Community).
[126] Case C-54/85 *Ministère Public against XavierMirepoix* [1986] ECR 0167, para.16. The CJEU stated that the national authorities of the importing Member State are obliged to review the prohibition on the use of a pesticide or a prescribed maximum level if it appears to them that the reasons which led to the adoption of such measures have changed'.

Commission, which has the power of legislative nature, to bring about an amendment to the rules in the light of the new information.[127] From there, the EU judiciary has assumed that continuous scientific monitoring and re-evaluation of precautionary measures are inherent elements of a proportionate application of the precautionary principle.[128]

In *Agrarproduktion Staebelow GmbH*, the CJEU gave effect to the so-called principle of precedence to justify the proportionality of a measure ordering the slaughter of a cohort of infected bovine animals to eradicate exposure of humans to BSE. The principle of precedence has been elegantly used by the EU judiciary to give priority to environmental/health concerns over economic interests and accept the legality of restrictive measures entailing precautionary bans and withdrawal of certain substances until further information becomes available.[129] In Chapter V, the author argued that the precedence principle can hardly be invoked, on the basis of the precautionary principle, to postpone the deployment of renewable energy technologies as this would have the effect of slowing down the achievement of climate-energy policy objectives.[130] What is more, the principle of precedence is subject to the proportionality principle.[131] Pursuant to the EC Communication on the precautionary principle, a ban or prohibition should be the maximum of what is normally tolerated by the proportionality principle.[132] Imposing a ban on innovative renewable energy technologies until greater scientific evidence

[127] Case C-504/04 *Agrarproduktion Staebelow GmbH v. Landrat des Landkreises Ba Doberan* [2006] ECR I-00679, para.40

[128] Nicolas De Sadeleer, 'The Precautionary Principle in European Community Health and Environmental: Sword or Shield for the Nordic Countries?' in De Sadeleer N., (ed.) *Implementing the Precautionary Principle: Approaches from the Nordic Countries, EU and USA* (London, Earthscan, 2007), pp.39-40

[129] Joined Cases T-74/00, T-76/00, T-83/00, T-84/00, T-85/00, T-132/00, T-137/00, & T-141/00, *Artegodan GmbH v. Commission* para.184 ; Case T-392/02 *Solvay Pharmaceuticals BV* [2003] ECR II-4555, para.121

[130] Chapter VI, section 6.2.2

[131] *Solvay Pharmaceuticals BV*, (n129), para.125

[132] European Commission, 'Communication on the Precautionary Principle', COM (2000) 1 final, at 17

becomes available to retire potential risks of adverse effect is not acceptable. 'Learning while doing' is certainly a better option.

Following along the same line, the EC Communication recommends that 'the measures must be maintained as long as scientific data are inadequate, imprecise or inconclusive and as long as the risk is considered too high to be imposed on society'.[133] On the other hand, the measures envisaged on the basis of precaution may have to be modified or abolished in light of new scientific findings[134] and depending on the follow-up of their impact.[135] The Communication acknowledges that the condition whereby precautionary measures should, as a matter of principle, be of temporary nature only concerns the scope of the Sanitary and Phytosanitary Agreement (SPS Agreement).[136] In other sectors such as the environment, different principles can apply.[137] Nonetheless, the EC seems to suggest that the maintenance of precautionary measures should depend on the results of continued scientific research 'in light of which they should be re-evaluated'.[138] From there, a truly precautionary approach appears to be predicated on the continuation of scientific monitoring to account for more complete scientific data. One ought to note that the Preamble of the Habitats Directive also recognises that the improvement of scientific and technical knowledge is essential for the implementation of the Directive and that it is consequently appropriate to encourage the necessary research and scientific work.[139]

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[133] Ibid, 19
[134] Ibid.
[135] Ibid.
[136] Agreement on the Application of Sanitary and Phytosanitary Measures (adopted 15 April 1994, in force 1 January 1995) 1867 UNTS 493 (SPS Agreement)
[137] Ibid, 20
[138] Ibid.
[139] Habitats Directive, Recital

The EC Communication and the case law cited above infer that a duty to monitor and to re-evaluate precautionary measures in light of new scientific evidence is the necessary corollary of a proportionate application of the precautionary principle. This clearly calls for the need to act despite scientific uncertainty and to respond to knowledge deficiency by means of constant re-evaluation. This is also the 'Achilles heel' of adaptive management. AM allows for provisional decisions to be made, monitored and re-evaluated as technical knowledge becomes available. Where the evidence presented in the AA process do not allow for meaningful evaluation of impacts, AM should be envisaged as good practice in light of the proportionality principle to engage truly provisional precautionary measures based on the best scientific knowledge.

The interplay between AM and the precautionary principle is complex. Chapter VI emphasises that their relationship has received some scant attention in the literature on the ecosystem approach. Commenting on Trouwborst' s seminal work,[140] Raitanen contends that 'the precautionary principle shares many converging features with the ecosystem approach and its management strategies'. For this reason, the precautionary principle should be 'a key element in legitimatizing more adaptive natural resources governance'.[141] Raitanen goes on to explain that adaptive law methods and processes are the regulative tools to operationalizing the precautionary principle.[142] In a similar vein, Morgera notes that the precautionary principle 'applies to International biodiversity law through adaptive management'.[143] In some jurisdictions, AM has sometimes been described as an alternative to the 'paralyzing' effect of the

[140] Arie Trouwborst, 'The Precautionary Principle and the Ecosystem Approach in International Law: Differences, Similarities and Linkages' (2009) 18 RECIEL, 26
[141] Elina Raitanen, 'Legal weaknesses and windows of opportunity in transnational biodiversity protection: as seen through the lens of an ecosystem approach-based paradigm' in Maljean-Dubois S., (ed.) *The Effectiveness of Environmental Law* (1st ed., Intersentia, 2018), 81, 97
[142] Ibid, p.97
[143] Elisa Morgera, 'The ecosystem approach and the precautionary principle' in Morgera E., Razzaque J., (eds.) *Biodiversity and Nature Protection Law* (Edward Elgar, 2017), 76

precautionary principle.[144] More pragmatic views envisage adaptive management and the precautionary principle as complementary approaches[145] in situations where, despite uncertainty, there is a strong 'call for moving in the dark rather sitting still'.[146] The author broadly shares this view. AM should not be envisaged as an alternative to the precautionary principle. Instead, AM integrates the best scientific knowledge that is needed to give an evidentiary basis to precautionary actions. Chapter VI concludes on this aspect that AM strategies have an important role to play, within the precautionary principle of Article 6(3), for filling data gaps and providing early warning indicators of adverse impacts on N2000 sites. The precautionary principle in turns demands temporary mitigation/compensatory measures to protect the integrity of N2000 sites until further scientific evidence is acquired through continuous monitoring.

Federal Agencies in charge of administrating biodiversity law in the United States have found it necessary to apply rigorous AM[147] to achieve the protection standards of 'no jeopardy' under the 1973 Endangered Species Act (ESA)[148] and the standard of 'least practicable adverse impact' under the Marine Mammal Protection Act (MMPA).[149] More than 20 years separate the enactment of the Endangered Species Act and the adoption of the Habitats Directive. The American case law under the ESA and MMPA is unarguably more developed than the CJEU case law under the Habitats Directive. Federal Courts have been particularly active in elaborating sophisticated standards under which AM frameworks can be lawfully implemented in compliance with the ESA

[144] *Pembina Institute for Appropriate Development v. Canada* (Attorney General) 2008 FC 302, para.32
[145] Jamie Benidickson and others, 'Practicing Precaution and Adaptive Management: Legal, Institutional and Procedural Dimensions of Scientific Uncertainty" Final Report Submitted to SSHRC and Law Commission of Canada (University of Ottawa, June 2005), at A8
[146] Holy Doremus, 'Precaution, Science and Learning While Doing in Natural Resource Management' (2007) 82 Washington Law Review, 547, 554
[147] Dennis D. Murphy, Paul S. Weiland, 'Guidance on the use of best available science under the U.S. Endangered Species Act' (2016) 58 Environmental Management, 1, 10
[148] Endangered Species Act 1973, section 7 (a) (2), [16 U.S.C. §1536 (a) (2)]
[149] Marine Mammal Protection Act 2012 [16 U.S.C. § 1371 (a) (5) (A) (i) (II) (aa)]

and MMPA. EU Courts could probably learn something from the lengthy experience of the US judiciary to frame the use of AM in the context of the Habitats Directive.

5 - The rule of adaptive management under the Endangered Species Act and Marine Mammal Protection Act

Notwithstanding the position of some commentators asserting that the flexible tenets of AM 'do not fit neatly' within the statutory requirements of the Endangered Species Act (ESA),[150] AM has achieved some success in US Federal Courts.[151] Federal Courts have defined a number of substantive legal standards that AM must satisfy to meet the statutory requirements of the MMPA[152] and the ESA.[153] While it is true that the jurisprudence on AM (below) primarily concerns large-scale public plans, take-home lessons can still be drawn to suggest how AM could be considered in the 'appropriate assessment' of the Habitats Directive. To get a deeper understanding of how US Courts treat the use of AM, it is worth briefly explaining the statutory backgrounds underpinning the ESA and MMPA.

[150] Ruhl J.B., 'Taking Adaptive Management Seriously: A Case Study of the Endangered Species Act' (2004) 52 Kansas Law Review, 1249, 1284 ('The [ESA] statute as a whole lacks a cohesive adaptive management architecture'); Holy Doremus, 'Adaptive Management, the Endangered Species Act, and the Institutional Challenges of New Age Environmental Protection' (2001) 41 Washington Law Journal,pp.50-89, 55 ('Our experience to date at the intersection of adaptive management and the ESA highlights the difficulty of surmounting these institutional barriers')

[151] Ruhl J.B., Robert L. Fischman, 'Adaptive Management in the Courts' (2010) 95 Minnesota Law Review, 424

[152] Marine Mammal Protection Act 2012 [16 U.S.C. 1361-1423]

[153] Endangered Species Act 1973 [16 U.S.C. 1531]

5.1. The authorisation regime under the ESA and MMPA

Similar to the Habitats Directive,[154] the ESA and MMPA have been criticised for being too strict,[155] failing to accommodate economic aspirations within their protection schemes.[156] Both regulatory instruments are also subject to growing criticisms for representing a regulatory constraint on the siting and permitting of renewable energy projects.[157] The ESA and MMPA are based on a mandate to use the 'best available science'.[158] However, unlike the CJEU, Federal Courts have been more proactive in defining what is required by this mandate within the scope of the 'arbitrary and capricious' standard of judicial review.[159] Recognising that 'the determination of what constitutes the best scientific data available' belongs within an agency's special expertise,[160] the Courts have nonetheless held that an agency's decision will be found 'arbitrary and capricious' if the agency ignores the available biological information before it.[161] More specifically, agencies 'cannot disregard available scientific evidence that is in some way better than the evidence they rely upon'.[162] In this respect, best available science does not necessarily mean using the best data *available* but the best scientific data *possible*.[163] What is more, in the absence of best available science,

[154] For a comparison: Jonathan Verschuuren, 'Effectiveness of Nature Protection Legislation in the European Union and the United States: The Habitats Directive and the Endangered Species Act' in Dieterich M., Van der Straaten J., (eds) *Cultural Landscapes and Land Use: The Nature Conservation-Society Interface* (Kluwer Academic Publishers, 2004) 39
[155] Ibid.
[156] Hendrik Schoukens, 'Habitat Restoration on Private Lands in the United States and the EU: Moving from Contestation to Collaboration' (2015) 11 (1) Utrecht Law Review, 33, 36
[157] Ruhl J.B., 'Harmonizing Commercial Wind Power and the Endangered Species Act Through Administrative Reform' (2012) 65 Vanderbilt Law Review, 1769; Megan E. Higgins and Jason Busch, 'Offshore Wind and Wave Energy and Ocean Governance' in Abate S.R., (ed.), *Climate Change Impacts on ocean and Coastal Law: U.S. and International Perspectives* (1st edn, Oxford University Press, 2015), 181; Amanda Right, 'Rough Seas for Renewable Energy: Addressing Regulatory Overlap for Hydrokinetic Projects on the Outer Continental Shelf' (2011) 95 Washington Journal of Law & Policy, 79
[158] 16 U.S.C. § 1536 (a) (2)
[159] Administrative Procedure Act, 5 U.S.C.§ 706 (2) (A)
[160] *Marsh v. Oregon Natural Resources Council*, 490 U.S. 360 (1989), at 377; *Miccosukee Tribe of Indians of Florida v. United States*, 566 F. 3d. 1257 (11th Circ.2009), at 1265
[161] *Conner v. Burdford,* 848 F. 2d. 1441, 1454 (9th Cir. 1988); *San Luis & Delta-Mendota Water Authority v. Locke,* 776 F. 3d. 971, 995 (9th Circ. 2014)
[162] *Kern County Farm Bureau v. Allen*, 450 F. 3d. 1072 (9th Circ. 2006)
[163] *Building Industry Association of California v. Norton,* 247 F. 3d. 1241 (DC. Cir. 2001), at 1246

agencies are to give 'the benefit of the doubt to the species',[164] which means that 'they should not proceed in the face of inadequate knowledge'.[165] Although not as stringent as the 'criminal like' standard of proof under Article 6(3), US Courts have enshrined a low evidentiary threshold to trigger the application of the ESA.[166] Plaintiffs only have to establish by a 'preponderance of the evidence' that the project is 'reasonably certain' to harm a listed species'.[167]

The ESA and MMPA seek to protect a number of marine species, including marine mammals and fish, by creating a prohibition against 'taking' any individual of a protected species.[168] 'Take' under ESA is defined to mean 'harass, harm, hunt, shoot, wound, kill, trap, capture or collect or to attempt to engage in any such conduct'.[169] 'Take' under the MMPA means to harass, hunt, capture or kill any marine mammals or attempt to do so.[170] The 'take' prohibition also includes the destruction and adverse modification of habitats designated for listed-species.[171] Any ORE project that has the potential to adversely affect a listed species will fall under these prohibitions and thus, may need to apply for an Incidental Take Permit.[172] In order to receive an Incidental Take Permit (ITP), project developers must develop a Habitat Conservation Plan (HCP).[173] The HCP is a detailed document that includes measures that a project

[164] *Roosevelt Campobello International Park v. EPA*, 684 F. 2d 1041, 1049 (DC Circ. 1982)
[165] Timothy O'Riordan, *Interpreting the Precautionary Principle* (1st edn, Earthscan, 1995), 210
[166] Ruhl J.B., (n157), 1786
[167] *Animal Welfare Institute v. Beech Ridge Energy LLC*, 675 F. Supp. 2d. 540 (D. Maryland 2009), at 563-564
[168] 16 U.S.C § 1538 (a) (1) (B); 16 U.S.C. § 1362 (13)
[169] Endangered Species Act, section 3 (19), [16 U.S.C. §1538 (19)]
[170] Marine Mammal Protection Act, [16 U.S.C. §1362(13)]
[171] *Babbitt v. Sweet Home Chapter of Communities for a Greater Oregon*, 515 U.S. 687 (1995); *Palila v. Hawaii Department of Land and Natural Resources*, 639 F. 2d. 495 (9th Circ. 1981)
[172] Endangered Species Act, section 10; Marine Mammal Protection Act section 101 (a) (5), 16 U.S.C.§ 1362 (a) (5) (A) (i)
[173] Ruhl J.B., (n157), 1781

developer will envisage to minimise and mitigate 'to the maximum extent practicable' the adverse impact on the species.[174] The ITP then binds the applicant to their HCPs.

Under the ESA, each federal agency shall ensure that any action authorised, funded or carried out by such agency (referred to as 'agency action')[175] is not likely to jeopardise the continued existence of an endangered or threatened species or result in the destruction or adverse modification of their critical designated habitat.[176] 'Jeopardy' is defined as 'engaging in an agency action that reasonably would be expected, directly or indirectly, to reduce appreciably the survival and recovery of a listed species by reducing the reproduction numbers or distribution of that species'.[177] There is no *de minimis* exception to this provision: the take of a single animal violates the Endangered Species Act.[178] Section 7 of the ESA imposes a duty on federal agencies to engage in formal consultation with a consulting wildlife service[179] where the actions they fund, authorise or carry out, is likely to jeopardy an ESA-listed species.[180] The consultation process culminates in the production/issuance of a Biological Opinion by the consulting service.[181] If jeopardy or adverse modification of habitats is found, the consulting wildlife service issues a 'jeopardy' opinion including 'reasonable and prudent alternatives' to be implemented by the 'action agency' and the project development to comply with the no jeopardy standard.[182] Where the consulting service finds that an action may adversely affect a species but not jeopardise its continued existence, or where there is prudent alternative for the agency to avoid jeopardy and adverse

[174] 16 U.S.C. § 1539 (a) (2) (B) (ii)
[175] Endangered Species Act, section 7 (a) (2), [16 U.S.C. §1536 (a) (2)]
[176] Ibid.
[177] Code of Federal Regulations, Title 50, para 402.02
[178] Gregg Badichek, 'Resolving Conflicts Between Endangered Species Conservation and Renewable Energy Siting: Wiggle Room for Renewables?' (2015) Consilience: The Journal of Sustainable Development, 1, 11
[179] National Oceanographic and Atmospheric Agency is the competent consulting service for marine species.
[180] Endangered Species Act, section 7 (a) (2)
[181] Ibid, section 7 (b) (3) (A), [16 U.S.C. § 1536(b) (3) (A)]
[182] *Ariz. Cattle Growers' Association v. U.S. Fish & Wildlife*, 273 F.3d. 1229, 1239 (9th Cir.2001)

modification of habitats, the service may issue an ITP, which if followed exempts the agency from the prohibition on takings found in Section 9.[183] The ITP must include the amount of anticipated 'take' allowable, along with reasonable and prudent measures that must be implemented to minimise the impacts of anticipated take, and the terms and conditions that must be observed by developers in their HCPs.[184] ITPs often commands the implementation of AM strategies in HCPs.[185]

In a similar language, the MMPA authorises the 'taking' of small numbers of marine mammals if taking is incidental to a specified activity.[186] The issuance of incidental authorisations under the MMPA is an action that requires consultation under section 7 of the ESA. The consulting wildlife service (NOAA Fisheries)[187] may authorise incidental take through an Incidental Harassment Authorisation (maximum one year)[188] or a Letter of Authorisation for longer term harassment (up to five years).[189] A letter of Authorisation can only be granted if the proposed activity will have a 'negligible impact' on such species.[190] The consulting service must find that the 'take' will have a 'negligible impact' on the species concerned[191] and issue regulations to achieve 'the least practicable adverse impact' before it can authorise incidental take. The regulation shall set forth the permissible method of taking and other means of effecting 'the least practicable adverse impact' as well as requirements related to monitoring and reporting.[192] Once incidental take authorisation has been taken in the scope of the ESA or MMPA, AM becomes a matter of securing compliance with the 'no jeopardy' and

[183] Endangered Species Act, section 7 (b) (3) (B)
[184] Endangered Species Act, section 7 (b) (3) (B) (4)
[185] Ruhl and Fischman, 'Adaptive Management in the Courts', (n151), p.463
[186] U. S.C. § 1371 (a) (5) (A)
[187] The National Oceanic and Atmospheric Administration (NOAA Fisheries) is the delegated authority to deliver Incidental Take Authorizations for oceanic marine mammals under the MMPA (16 U.S.C. § 1362 (12))
[188] U. S.C. § 1371 (a) (5) (D)(i)
[189] U. S.C. § 1371 (a) (5) (A) (i)
[190] U. S.C. § 1371 (a) (5) (A) (i) (I)
[191] U.S.C. § 1371(a)(5)(A)(i)(I).
[192] U.S.C. § 1371 (a) (5) (A) (i) (I) (II)

‘least practicable adverse impact’ standards. AM processes envisaged in developers’ HCP must also satisfy these standards to comply with the ESA and MMPA.

5.2. Adaptive management in the US jurisprudence

Federal case law has provided substantive standards to review the legality of adaptive management plans elaborated under the ESA and the MMPA.[193] The most comprehensive reviews of AM case law have been published by Ruhl and Fishman.[194] Despite a relatively sparse body of jurisprudence,[195] Ruhl and Fishman note that Federal Courts have begun to support the use of AM and developed substantive legal standards to overturn what those authors refer to as ‘adaptive management lite’ or ‘AM-lite’[196] This approach is considered a ‘watered down’[197] version of passive AM in which ‘management objectives are loosely defined, monitoring protocols are vague and management actions triggered by monitoring thresholds are not clearly detailed’.[198] ‘AM- lite’ ‘resembles *ad hoc* contingency planning more than it does structured learning while doing’.[199] At best, ‘AM-lite’ complements the ‘front end’ analysis with ‘bold promises to adapt unspecified parameters of the decision through unspecified methods when unspecified conditions arise’.[200] At worst, this ‘compromised version’[201]

[193] Benson and Schultz, ‘Adaptive Management and Law’, (n5), 48
[194] Robert L. Fischman, Ruhl J.B., ‘Judging adaptive management practices of US agencies’ (2015) 30 (2) Conservation Biology, pp.268-275; Ruhl and Fischman, (n151), 424
[195] Courtney Schultz and Martin Nie, (2012a), ‘Decision-Making Triggers, Adaptive Management and Natural Resources Law and Planning’ (2012) 52 Natural Resources Law Journal, 443, 457
[196] Fischman and Ruhl, (n194), at 268; Ruhl and Fischman, (n151), at 441
[197] Ruhl and Fischman, (n151), 426
[198] Miguel F. Frohlich and others, ‘The relationship between adaptive management of social-ecological systems and law: a systematic review’ (2018) 23 (2) Ecology and Society, 23
[199] Ruhl and Fischman, (n151), 426
[200] Robin K. Craig, Ruhl J.B., ‘Designing Administrative Law for Adaptive Management’ (2014) 67910 Vanderbilt Law Review, 1, 11
[201] Ibid, 11; Green and Garmestani, ‘Adaptive Management to protection Biodiversity’, (n3), 171

of AM holds little promise to reduce scientific uncertainty[202] and to meet the regulatory standards of the ESA and MMPA.[203]

It is settled case law that in order to avoid a substantive violation of the prohibition against jeopardy, mitigation measures adopted as part of an AM plan, must be 'reasonably specific, certain to occur, and capable of implementation; they must be subject to deadlines or otherwise enforceable obligations; and most importantly, they must address the threats to the species in a way that satisfies the jeopardy and adverse modification standards'.[204] These requirements have been repeatedly endorsed in US litigation on AM.[205] In two related cases, *Pacific Coast Federation of Fishermen's Association*[206] and *Natural Resources Defense Council v Kempthrone*,[207] the District Court of California had to review the legality of two AM plans adopted to reduce uncertainty as to the impacts of two federally-managed water projects on two ESA-listed species. For example, in *Pacific Coast Federation of Fishermen's Association*, the District Court upheld the salmonid AM plan for a Californian water infrastructure project because it contained 'enforceable, definitive and certain requirements'[208] to ensure that the salmonid species or its critical habitats would not be in jeopardy. The Court found that the AM plan contained 'definite' and 'non-discretionary' criteria, formulated as maximum temperature thresholds, which if met or exceeded, triggered enforceable mitigation measures.[209] Mitigation responses were formulated as a non-discretionary mandate to re-initiate consultations (with the consulting service) in order

[202] Fischman and Ruhl, (n194) 271
[203] Robin K. Craig and others, 'A proposal for amending administrative law to facilitate adaptive management' (2017) 12 Environmental Research Letters, 1
[204] *Center for Biological Diversity v. Rumsfeld*, 198 F. 2d. 1139 (D. Az. 2002); Sierra *Club v. Marsh*, 816 F. 2d. 1376 (9th Circ.1987), at 1152
[205] Martin A. Nie, Courtney A. Schultz, (2012b) 'Decision-Making, Triggers in Adaptive Management' (2012) 26 Conservation Biology, 1137
[206] *Pacific Coast Federation of Fishermen's Association*, 606 F. 2d. 1122 (E. D. Calfi.2008)
[207] *Natural Resources Defense Council v. Kempthorne*, 506 F. 2d. 322 (E.D. Cal. 2007)
[208] *Pacific Coast Federation of Fishermen's Association*, at 1185
[209] Ibid, 1185, 1188

to adjust water system operations before annual water delivery decisions could be made.[210] Further, in its determination, the Court held that the required action-mitigation measures were included in the Incidental Take Statement and as such, were ‘sufficiently certain to be enforceable’ under civil and criminal law.[211]

By contrast, in *Natural Resources Defense Council v Kempthrone,* the Court rejected the AM plan for the smelt species, referred to as the Delta Smelt Risk Assessment Matrix (DSRAM). The Biological Opinion’s primary protection scheme for the smelt relied on the implementation of the DSRAM. Although the AM process was ‘within the agency’s discretion to choose and employ, the absence of any definite, certain or enforceable criteria or standards make its use arbitrary and capricious under the totality of the circumstances’.[212] Here, the triggering criteria warranting responsive action-mitigation were clear and well-defined. However, the Biological Opinion and the DSRAM provided for a discretionary mitigation process whereby recommendations of fish protection actions would be forwarded to a separate management group ‘for discussion and potential implementation’[213] should one of these triggers be met or exceeded.[214] Fish mitigation actions included, among other things, changes in south delta stream barrier operations, changes in river flows, and changes in the operation of the Delta cross channel.[215] The DSRAM did not contain further defined action criteria but left the specifics of responsive actions to the discretion of the working group.[216] The Court held that the existing AM process provides absolute no certainty that needed protection actions for the delta smelt will be taken at any time. Although mitigation measures were identified, ‘no defined mitigation goals were required, nor was any time

[210] Ibid, at 1185, 1186
[211] Ibid, at 1185, 1188
[212] *Natural Resources Defense Council v. Kempthorne,* 506 F. 2d. 322 (E.D. Cal. 2007)
[213] Ibid, at 351
[214] Ibid, at 341
[215] Ibid, at 341
[216] Ibid, at 341

for implementation prescribed'.[217] From there, the Court considered that the 'DSRAM, as it was structured, did not provide reasonable certainty that appropriate and necessary mitigation measures will be implemented'[218] and that adverse impacts would be mitigated.[219] In the view of the Court, the plan was merely a discretionary process devoid of any clear requirements to take actions and as such, it was legally insufficient to meet the ESA legal requirement of 'no jeopardy'.

These two judgements are still described to date as the most 'thorough judicial discussion of AM strengths and weaknesses'.[220] These further demonstrate that an 'appropriate balance' can be struck between the incident flexibility of AM and the need for legal certainty prescribed by law.[221] The legal standards elaborated in these cases have continued to inform trade-offs contemplated by Courts.[222] For example, in an another instructive decision in *Animal Welfare Institute v Beech Ridge Energy,*[223] the District Court of Maryland acknowledged that AM was 'the best way to reduce the risk of death and injury' posed to bats by the wind energy project but eventually rejected the AM process on the grounds that the project developer was 'not currently required to implement any minimisation or mitigation techniques'.[224] The Order authorising the construction and operation of the wind farm provided that it was only in the event of 'significant levels of bat mortality' that the developer would be required to make 'a good faith effort to implement adaptive management strategies'.[225] It is not necessary to address the content of the AM plan in detail here. Suffice to say that the Court rejected

[217] Ibid, at 355
[218] Ibid, at 357
[219] Ibid.
[220] Ruhl and Fischman, (n151), 466
[221] *Pacific Coast Federation of Fishermen's Association*, (n206) at 1188; Craig and others, (n203), 1
[222] Ruhl and Fischman, (n151), 466
[223] *Animal Welfare Institute v. Beech Ridge Energy LLC*, 675 F. 2d. 540 (D. Maryland 2009)
[224] Ibid, at 579
[225] Ibid, at 554

the AM process because the responsive mitigation actions envisaged were 'entirely discretionary' and as such, could not eliminate the risks to the listed bat species.

Similarly, for AM to suffice as a basis for delisting the Grizzly Bear from the ESA list of threatened species, 'more specific management responses tied to more specific triggering criteria are required'.[226] In this case, the US Fish Wildlife Service relied on the premise that scientists would continue to monitor relationships between food declines and size of grizzly population and that specific thresholds of change in mortality rates, litter size and cub survival would lead the scientific team 'to recommend appropriate management responses'.[227] Although the Strategy was based on an intensive management and monitoring programme, the Court pointed out that, unfortunately, these were not legally-binding and not responsive to food declines.[228] The Court further noted that 'the regulatory mechanisms relied upon by the Service [...] depend on guidelines, monitoring, and promises or good attention for future actions'.[229] Promise of good intentions to take future actions 'are not the rules of law' if there is 'no way to enforce them or to ensure that they will occur'.[230]

This also holds true with regards to AM plans elaborated to satisfy the standard of 'least practicable adverse impact' under the MMPA. A recent judicial opinion states that 'the duty to adopt in advance measures to ensure the least practicable adverse impact cannot be met simply by deferring to potential unknown measures'.[231] In this case, the National Oceanographic and Atmospheric Administration issued a rule authorising the incidental take of marine mammal by the Navy's use of low-frequency sonars during training

[226] *Greater Yellowstone Coalition v. Servheen*, 672 F. 2d. 1105 (D. Mont. 2009), at 1019
[227] Ibid, at 1029
[228] Ibid.
[229] Ibid, at 1118
[230] Ibid.
[231] *Natural Resources Defense Council v. Pritzker*, 828 F.3d. 1125 (9th Circ. 2016)

exercises. The Final Rule included mitigation measures to minimise the impacts of the 'incidental take' and planned to engage in AM to develop more effective mitigation over time but failed to specify how the sonar mitigation measures envisaged in the AM process will achieve the MMPA's standard of 'least practicable adverse impact' on marine mammals. It merely stated that new information will be considered to continue developing more effective mitigation for sonar operations through the AM process. Citing the *Greater Yellowstone Coal v Servheen* case, the Court held that 'the mere possibility of changing the rules to accommodate new information does not satisfy the MMPA's strict requirements for mitigating the effects of incidental take'.[232]

In New Zealand, the Supreme Court has also elaborated its jurisprudence on AM in cases involving resource consents for aquaculture farms. The Court has developed judicial standards that broadly reflect those elaborated by US Federal Courts. The 'vital part of the test' involves evaluating whether an AM process will sufficiently reduce the risk and the uncertainty. This requires the presence of the following factors: 1) collection of good baseline data on the receiving environment, 2) consent conditions providing for effective monitoring using appropriate indicators, 3) thresholds set to trigger adaptive responses before the effects become overly damaging; and 4) the effects that might arise can be remedied before they become irreversible.[233] These factors determine the consistency of an AM process with the precautionary principle (see below).

In summary, Federal Courts have allowed the use of AM as long as compliance with the substantive standard of 'no jeopardy' could be demonstrated with reasonable certainty. As a matter of principle, AM frameworks have generally failed to pass judicial review

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232 Ibid, at 1142

233 *Sustain our Sounds Incorporated v. The New Zealand King Salmon Company Ltd* [2014] NZSC 40, para.133

where they lacked clear objectives and monitoring requirements with pre-agreed and definite triggers that, if met or exceeded, prompt the adoption of enforceable remedial actions.[234] AM processes must provide 'reasonable certainty' that the legal protection standards of the ESA and MMPA will be satisfied. AM plans that provide for specific monitoring requirements and explicit trigger points tied to clear mitigation requirements and implementation timeframes are more likely to meet the standards of 'no jeopardy' and 'least practicable adverse impact'.[235] If a threshold of unacceptable change or harm is threatened, competent authorities must be bound to take corrective mitigation actions. Mitigation measures must be 'reasonably specific, certain to occur and capable of implementation'.[236] Competent agencies must also demonstrate a clear commitment to act in the face of new scientific evidence.[237]

[234] Fischman and Ruhl, (n194), 271
[235] Schultz and Nie, (2012a), (n195), 505
[236] *Natural Resources Council v. Kempthorne,* Op. cit., at 350; *Centre for Biological Diversity v Rumsfeld*, Op. cit, at 1152
[237] *National Wildlife Federation v. National Marine Fisheries Service*, 524 F. 3d. 917 (9th Circ. 2008)

6 – ‘Take home lessons’: balancing adaptive management and the precautionary principle under the appropriate assessment of the Habitats Directive

Some commentators write that ‘innovative ways will have to be pursued to balance the flexibility needed for adaptive management and the [certainty] demanded by law’.[238] At first glance, facilitating AM in the context of the AA process necessarily demands a degree of flexibility in the application of the precautionary principle. ‘Ascertain’ should no longer be understood as a ‘static’ standard to be satisfied from a strict *ex ante* perspective in the initial AA process.[239] Better ecological outcomes reconciling ORE and biodiversity protection could be achieved if ‘ascertain’ was jurisprudentially re-interpreted as an ‘active’ standard to be satisfied through constant requirements for monitoring, reporting and adjustment of mitigation/operating conditions on the basis of feedbacks observed during deployments. The AM process will then become a matter of eliminating all reasonable scientific doubts while ensuring that construction, operation and functioning of consented ORE projects continue to comply with the standard of ‘no adverse impact on the integrity’ of N2000 sites. As such, AM would work well as a ‘compliance tool’ whereby the implications of ORE projects for N2000 sites are continually monitored and adjustments are made in responses to specific circumstances in order to ensure adherence to the legal protection standard of Article 6(3). Stated differently, AM could be envisaged as a ‘structured process’ to assure compliance with the legal standard of ‘no adverse impact on the integrity’ of N2000 sites.

Such re-interpretation is interesting in that it has for effect to shift ‘the precautionary principle away from its substantive [front-end] function in decision-making, moving it

[238] Frohlich and others, (n198), 31

[239] Chapter IV have highlighted the important doctrinal role given by the CJEU to the precautionary principle to interpret the requirement to ‘ascertain’. ‘Ascertain’ is jurisprudentially understood as a static *ex-ante* standard requiring of licensing of authorities to establish, beyond reasonable scientific doubt, the absence of threat to N2000 sites.

into a process oriented role'.[240] In her seminal paper on 'precaution and adaptive management in wildlife trade', Wiersema argues that the primary way the parties to CITES[241] have given effect to the precautionary principle within AM in the listing process of species is by restricting it to a procedural role of risk assessment, monitoring and information gathering.[242] Wiersema argues that this 'procedural adaptive management version of precaution' is a necessary albeit insufficient implementation of the precautionary principle. It fails to acknowledge that uncertainty in wildlife conservation goes beyond data gaps and may result from complexity and variability which cannot always be remedied by accumulating more data. Hence, the precautionary principle plays a dual role within AM: a procedural role and a substantive protection role. As stated above, the procedural aspects of precaution should stem from the requirements of the proportionality principle. These include the need to implement continuous scientific monitoring and re-evaluation of precautionary measures. The substantive function of the precautionary principle within AM in turn serves as a constant reminder of the limits of science and informs interim mitigation actions until further conclusive evidence is achieved from monitoring. In this sense, Wiersema concludes that 'the substantive and procedural roles for precaution [within adaptive management] work together'.[243] The author agrees but defends a slightly different view whereby adaptive management is the procedural framework that allows the precautionary principle to play its substantive role, not only from a strict front-end perspective in decision-making, but also iteratively throughout the post-consenting phase.

[240] Annecoos Wiersema, 'Uncertainty, Precaution, and Adaptive Management in Wildlife Trade' (2015) 36(3) Michigan Journal of International Law, 378, 394
[241] Convention on International Trade in Endangered Species of Wildlife Fauna and Flora (adopted 3 March 1973, entered into force. 1st July 1975) 27 UNTS 1087 (CITES)
[242] Ibid, p.417
[243] Wiersema, (n240), at 422

Implementing adaptive management within the confines of the precautionary principle however demands rigorous procedural safeguards and commitment to communicate uncertainty with transparency. AM should not be used to offer unbounded discretion to regulatory decision-makers and lessen the protection standard of the Habitats Directive. In line with the US case law, 'adaptive management cannot substitute for a showing of reasonable certainty that substantive legal criteria [of no jeopardy] will be met'.[244] Shultz and Nie note that, 'if Agencies choose to proceed despite uncertainty, they must demonstrate that substantive standards will be met in the future, that they have specific and enforceable monitoring and mitigation strategy that is within their power to implement if unacceptable effects are detected'.[245] US Courts have made a strong case against a 'trial and error' approach to AM that fails to establish the link between monitoring, pre-determined triggers/criteria and responsive mitigation actions. Monitoring plans, mitigation commitments and their associated trigger points must be clear, non-discretionary and enforceable for AM to survive judicial scrutiny. All these elements must be agreed upon in the set-up phase of peer-reviewed AM plans.[246]

The use, in the design stage, of triggers or thresholds has been described as critical to reconcile the theory of AM with precaution and the legal certainty demanded by law.[247] Schultz and Nie assert that the use of trigger mechanisms in AM 'came as a result of litigation [mentioned above] and the need to provide a more precautionary, science-based, and assured way of meeting the strictures of the ESA'.[248] The same authors explain elsewhere that decision-making triggers 'can be used to increase accountability, by predefining points at which an AM plan will be revisited and re-evaluated and thus

[244] Ruhl and Fischman, (n151), 472
[245] Schultz and Nie, (2012a), (n195), 520
[246] Holy Doremus, 'Adaptive Management as an Information Problem' (2010) 89 North Carolina Law Review, 1455, 1481
[247] Schultz and Nie, (2012a), (n195), 443
[248] Ibid, 473

improve the application of adaptive management in a complicated legal context'.[249] In a similar vein, MacDonald and Styles also argue that the value of using a 'trigger approach' in environmental approvals 'lies in their capacity to incorporate new information and monitoring data whilst ensuring legal accountability'.[250]

Similar judicial criteria could be applied by the EU judiciary in the context of the Habitats Directive to give the precautionary principle a substantive role within adaptive management and provide legal certainty that the AM process will be effective in reducing uncertainty and securing compliance with the standard of Article 6(3). In order to 'ascertain' that no adverse impact on the integrity of the site will come about, the use of an AM plan would have to be clearly circumscribed and deployed in combination with structured monitoring and clear scientific triggers so that the process does not lack certainty, but rather establishes a regime which permits adjustments within pre-defined project parameters. Implementing AM in a 'trigger approach' will provide regulators with a degree of certainty that protection of N2000 features will be ensured and that acceptable thresholds of change/harm will not be exceeded.

The adoption of precautionary/conservative thresholds and associated monitoring triggers are paramount to reconcile the AM process with the precautionary principle. Thresholds of 'acceptable' change or harm determine the maximum degree to which a proposed development can alter the receiving ecosystem. In Chapter VI, thresholds have been qualified by the author as values to be avoided throughout the lifetime of a project to maintain its compliance with N2000 sites' conservation objectives. Monitoring triggers in turn indicate unexpected or unfavourable progress towards unwanted thresholds of change or ham. Within AM, monitoring triggers shall identify 'what and when corrective mitigation actions will be taken if monitoring information show x or

[249] Nie and Schultz, (2012b), (n205), 1137
[250] McDonald and Styles, 'Legal Strategies for Adaptive Management', (n21), 47

y'.[251] As such, they serve as early warning indicators for 'legal compliance' with the standard of no impact on the integrity of the site.

AM processes should be directly incorporated into licensees' environmental management plans (EMP) and drafted with considerable care. In order to avoid 'AM-lite' practices and successfully pass judicial scrutiny, EMPs will have to contain clear and objective thresholds, a structured monitoring framework together with measurable triggers linked to specific actions and timelines. The devil is in the details The content of an EMP adopted for N2000 qualifying features should identify exactly what will be monitored how and when monitoring data will trigger a change in mitigation actions, and what mitigation actions will be taken or reduced overtime.[252]

The feedback-loop process of AM must be clearly articulated in the EMP by linking each monitoring trigger to a pre-determined set of mitigation measures. This means that, for each development phase, the EMP must explicitly stipulate what alternative/remedial mitigation actions will be implemented once a monitoring trigger is reached. Once approved by the competent licensing authority, the content of the EMP becomes legally binding on developers and licensing authorities as a result of its incorporation in the conditions of the licence. Pursuant to the polluter pays principle, developers remain responsible for completing required monitoring works and providing licensing authorities with regular reports showing adherence to licensing conditions. Monitoring data should then be reviewed by developers, representatives of the licensing authority and an independent scientific advisory group.

Whilst it clearly goes beyond the scope of this study to anticipate the content of developers' EMP, the AM process could perhaps be formulated as a 'monitoring and mitigation matrix' where measurable monitoring triggers are explicitly linked to

[251] Schultz and Nie, (2012a), (n195), 455
[252] Nie and Schultz, (2012b), (n205), 1142

corresponding on-site and off-site remedial actions. For example, the EMP for the single SeaGen tidal turbine initially provided for a marine mammal detection perimeter of 250m to trigger manual shut down of the turbine. The precautionary trigger of 250m was then progressively reduced to 30m as understanding of marine mammal behaviour increased thereby, reducing the number of shutdown actions (Chapter VI).[253] While this type of trigger can potentially be utilised with respect to all ORE technologies, the use of triggers as a means to reconcile AM with the precautionary principle faces a number of challenges.[254] At larger development scale, there is a risk that the 'trigger event' is detected too late and as such, that remedial mitigation measures fail to effectively respond and avert an adverse impact on a qualifying feature. Triggers for remedial actions should be used in a precautionary way, which means that they should be set at a point below a significant impact on the sites' conservation objectives so that adverse effects can be remedied before transgressing an acceptable threshold of change/impact. This is a *sine qua none* for adaptive management to be truly precautionary. The 'level of statistical certainty' in monitoring should also serve as a reference point to set 'more or less' precautionary triggers.[255]

US Federal Courts and the Supreme Court of New Zealand tend to accept a lower standard of evidence, stating that 'reasonable certainty'[256] or 'reasonable assurance'[257] that the AM process will achieve its goals in adequately reducing uncertainty and mitigating potential impacts suffices to show compliance with legal protection standards. At this stage, it is unclear how the iterative elements of adaptive management will comply with the evidentiary threshold taken by the CJEU in *Moorburg* (cited

[253] Graham Savidge and others, (2014), 'Strangford Lough and the SeaGen Tidal Turbine' in Mark A. Shields, Andrew I.L. Payne (eds.) *Marine Renewable Energy Technologies and Environmental Interactions* (Springer, 2014), 153, 158
[254] Eric Biber, 'Adaptive Management and the Future of Environmental Law' (2013) 46 Akron Law Review, 933, 961
[255] Nie and Schultz, (2012b), (n205), 1142
[256] *Pacific Coast Federation of Fishermen's Association*, 606 F. 2d. 1122 (E. D. Calfi.2008), para.353
[257] *Sustain our Sounds Incorporated v. The New Zealand King Salmon Company Ltd* [2014] NZSC 40, para.125

above). Pursuant to the CJEU's jurisprudence, any EMP embedding an adaptive management approach should provide definitive data to guarantee, beyond all reasonable scientific doubt, that the mitigation measures envisaged in an AM process will achieve their goal in preventing adverse impacts on the integrity of the site.[258] In *Grace and Sweetman*, the Court may have taken a more nuanced approach whereby it is only when it is 'sufficiently certain that a [mitigation] measure will make an effective contribution to avoiding harm, guaranteeing beyond all reasonable doubt that the project will not adversely affect the integrity of the area', that such a measure may be taken into account in the AA of Article 6(3).[259] While a conclusion of no reasonable scientific doubt as to the absence of adverse impacts on N2000 sites should be the ultimate goal pursued by an AM process, 'sufficient certainty' in the design phase that mitigation measures will make an 'effective contribution' towards this objective, may suffice for AM plans to pass the legal test of Article 6(3). This interpretation appears to be consistent with the EC guidelines on the implementation of the Birds and Habitats Directive in estuaries and coastal zones.[260] It is in this document that the only mention to AM in relation to the implementation of the assessment requirements of the Habitats Directive can be found. The Guidelines recognise that an adaptive approach to implementation of a plan or project may be envisaged where competent authorities cannot fully ascertain the adverse effects because of 'science limits' or 'uncertainty on the functioning of complex and dynamic ecosystems'.[261] In this case, 'rigorous monitoring scheme' and a 'pre-defined validated package of corrective measures' must be foreseen. Such corrective measures must guarantee that the 'initially unforeseen

[258] Case C-142/16 *Commission v. Germany* (*Moorburg)* [2017] ECLI: EU :C: 2017:301, paras.38, 43
[259] Case C-164/17 *Grace and Sweetman v. An Bord Pleanála* [2018] ECLI:EU:C: 2018:593, para.51
[260] European Commission, 'Guidance on the implementation of the Birds and Habitats Directive in estuaries and coastal zones' (November 2011). <https://publications.europa.eu/en/publication-detail/-/publication/59287682-5723-464c-8e5c-b6f6fc263eaf/language-en> (accessed 12 October 2018)
[261] Ibid, at 33

adverse effects' will be neutralised.[262] These Guidelines apply to estuaries and coastal zones which mean that most ORE projects fall outside of their geographical scope of application. There are no reasons why similar guidelines could not also be adopted under the guidance documents envisaged by the Action Plan for 'nature, people and the economy'.

Overall, the question of whether AM is consistent with the precautionary principle should always be informed by the level of uncertainty and severity of the consequences if an impact materialises. Where the *ex-ante* uncertainty and/or the seriousness of the likely adverse impact is high, the framework of AM may be best reconciled with the precautionary principle if implemented through a phased approach to licensing. Under a staged licensing process, a proposed development is allowed to expand in stages, starting at small scale or in a small spatial area. The approval of any subsequent phase is made conditional upon monitoring results showing that relevant thresholds are not triggered. Implementing AM in this way provides a mechanism to reduce uncertainty while ensuring that no unintended adverse impacts will occur due to the absence or imprecision of information relied upon for the initial approval.

It is worth making one final point here. For AM to be implemented in compliance with the requirements of the Habitats Directive, a flexible approach to risk may need to be recognised within the statutory N2000 conservation objectives.[263] Le Lièvre *et al*, argue elsewhere that: 'in order to increase our understanding about the interactions of N2000 qualifying features and ORE projects, it may be necessary for the tolerance of risks to be reflected in the statutory conservation objectives'. They further contend that 'if the qualifying interests are considered to require strict "zero tolerance" protection, the

[262] Ibid, 34
[263] Le Lièvre C., O'Hagan A.M, Culloch R. Bennet F., (2016). Legal Feasibility of implementing a risk-based approach and compatibility with Natura 2000 network. Deliverables 2.3 & 2.4 RiCORE project. 53pp., at 25

outcomes will be that both the N2000 sites and the areas of spatial connectivity with these protected species/habitats will be poorly suited to undertaking AM and potentially authorising ORE projects'.[264] Without a degree of flexibility, no impact can be accepted and an AM approach will not be suitable. Statutory conservation objectives are not determined by Courts but by scientists who understand the role of adaptive management in increasing the predictive capacity of environmental assessments. AM may be stipulated under statutory conservation objectives as a requirement that critical species thresholds are not exceeded and that these thresholds can be determined through a process of adaptive management.

[264] Ibid.

7 - Analysis of the thesis

Within this thesis, the author has explored the legal and technical feasibility of incorporating the principles of adaptive management into the AA process of the Habitats Directive. The author did so from the point of view of the strict application of the precautionary principle under the regime of Article 6(3) of the Habitats Directive. The major question addressed in this contribution was how realistic the judicial interpretation of the precautionary principle under the regime of Article 6(3) is in the context of ORE deployments. The research also raised the important question of how adaptive management can be best implemented within the confines of the precautionary principle of Article 6(3) to enhance the outcomes of the AA process in the face of scientific uncertainty as to the potential impacts of ORE projects on marine N2000 sites. During this research, serious issues and points of interest were raised in relation to 1) the current state of scientific knowledge regarding the interactions of ORE technologies with marine wildlife, 2) the absence of clear judicial understanding of 'scientific uncertainty', 3) the interplay between the Union's energy policy and environmental policy under the legal system established by the Lisbon Treaty and 4) the complex legal interactions between the environmental integration principle of Article 11 TFEU and the constitutional objective of sustainable development. Further, this research applied elements of trans-disciplinarity by developing an interim adaptive management framework for ORE permitting under the Habitats Directive. From there, I believe that this thesis answered, at least partially, the interrogation posed by Jackson in 2011: 'are provisions aimed at biodiversity protection sacrosanct, even if their application impedes policies aimed directly at addressing climate change?'[265] My research has shown that separating these two imperatives is a false dichotomy. It went further to suggest

[265] Jackson, 'Renewable energy vs. Biodiversity', (n15), 1195

practical solutions, grounded in law and in science, to facilitate greater penetration of offshore renewable energy without adversely impacting upon marine N2000 sites.

The rigid interpretation of the precautionary principle under the AA requirements of the Habitats Directive has been found to significantly slow down the process of energy transition which lies at the heart of sustainable development. If the Habitats Directive does not place a general ban on ORE developments, the evidentiary standard of 'no reasonable scientific doubt' under Article 6(3) has been found to place an unrealistic onus on ORE developers to prove the absence of threat to marine N2000 sites. The dogmatic approach to biodiversity conservation taken by the EU judiciary clearly epitomises a strong normative interpretation of the environmental integration principle of Article 11 TFEU.[266] As a constituent principle of sustainable development, the environmental integration principle cannot however be operated to give absolute priority to biodiversity protection goals over policy objectives related to renewable energy. There is in the European Union legal order 'a systemic legal argument' whereby 'the founding Treaties form a consistent legal system'.[267] This means that, to the extent possible, 'Treaty provisions should be interpreted so as to help and not hinder, the EU's other policy objectives'.[268] This approach, Voigt explains, is also justified when interpreting secondary EU law.[269] A great deal has changed since the Court sparked mayhem in its seminal *Waddenzee* case. The Lisbon Treaty, which came into force in 2009, formally introduced the objective of combating climate change as a policy objective to be pursued under the environmental policy competence.[270] In this vein, renewable energy has been found to be a significant driver of integration, sometimes

[266] Jordan and Lenschow, 'Environmental Policy Integration: A State of the Art Review' (2010) 20 Environmental Policy and Governance, 147
[267] Nicolas De Sadeleer, *EU Environmental Law and the Internal Market* (Oxford University Press, 2014), 25
[268] Suzanne Kingston, 'Why environmental goals should play a role in EU Competition policy: a legal systemic argument' in Kingston S., *Greening of EU Competition Law and Policy* (Cambridge University Press, 2011), 97
[269] Ibid.
[270] Article 192 TFEU

blurring the separation between environmental and energy policy under the Lisbon Treaty. The promotion of renewable energy has been given a place in the Pantheon of 'overriding requirements' for environmental protection justifying restrictions to the single market.[271] More recently, it has been recognised by the EU judiciary as paramount to realise the objective of sustainable development.[272] As a manifestation of the environmental integration principle, the doctrinal role of the precautionary principle cannot therefore become a 'rhetorical device' to thwart the expansion of ORE developments.

Uncertainty is an unavoidable pattern of all scientific investigations in the marine environment. Accepting that there will always be uncertainties about the ecological interactions of new ORE technologies demands new paradigms of environmental integration in order to achieve more sophisticated trade-offs between the demand for offshore renewable energy and protection of N2000 sites. In this respect, the dynamic nature of marine ecosystems coupled with the inherent limitations of scientific observation methods have been recognised to necessitate a departure from the traditional 'command and control' approach to authorisation in favour of AA processes that better embed adaptive management principles. Without lowering the protection standard of the Habitats Directive, this research has demonstrated that AM, in its non-experimental/passive form of implementation, can be designed within the precautionary principle of Article 6(3) of the Habitats Directive to enhance the treatment of scientific uncertainty under the AA process and help us achieve desirable trade-offs. A threshold-based approach to AM has been developed as a feasible methodology to maximise the use of best scientific knowledge while reconciling the need for offshore renewable

[271] Case C-573/12 *Ålands Vindkraft AB v. Energimyndigheten* [2014] EU: C: 2014:2037, paras.76-81; Joined Cases C-204/12 to C-208/12, *Essent Belgium NV v. Vlaamse Reguleringsinstantie voor de Elektriciteitsen Gasmarkt* [2014] ECLI: EU: C: 2014:2192, para.90-95

[272] Case C-346/14 *European Commission v. Republic of Austria (Schwarze Sulm River)* [2016] ECLI:EU:C: 2016:322, para.73

energy and protection of marine N2000 sites. As an interim solution, the methodological framework elaborated in Chapter 6 can be further enhanced and updated in tandem with improvements in the accuracy of monitoring methods and scientific modelling tools. Some parties and commentators will always resist a more flexible precautionary principle under the N2000 protection scheme to encourage greater penetration of offshore renewable energy. In this respect, the author is conscious of the growing concern among legal scholars whereby adaptive management is not completely 'safe-to-fail'.[273] Citing Crieg and Murray's earlier work, leading Canadian author Olszynski considers AM as 'safe fail', which means that 'it should only be applied when failure is an acceptable outcome'.[274] Adaptive management can help us 'recognize management mistakes and limit the damage they cause by modifying or correcting them expeditiously'.[275] However, Doremus reminds us that no form of adaptive management, no matter how rigorous, can guarantee successful resource protection.[276] From there, the hypothesis defended by this thesis is not a 'one-size-fits-all' approach. AM may not be appropriate for highly sensitive and endangered species. If the overriding goal is to protect features of high conservation value, the need to protect these sensitive features should be more important than the desire to address uncertainty associated with ORE developments. In this respect, the conservation status of the species concerned should inform the 'risk appetite' of regulators and developers. Where there is significant uncertainty as to the impact of a development on a declining species, a low threshold of risk tolerance should always be preferred.

[273] Martin Olszynski, 'Failed experiments: An Empirical Assessment of Adaptive Management in Alberta's Energy Resources Sector' (2017) 50 UBC Law Review, 709, 697
[274] Ibid.
[275] Doremus, 'Precaution, Science and Learning While Doing' (n146), 50, 53
[276] Ibid.

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